

THE Color Computer

March 1984

\$2.95

For Users of TRS-80™
Color Computers



- Communications: ● A Look at Databases ● Color Computer Terminal ● A Hardware Mod to Videotex
- EPROM Burner by Kitsz ■ 3-D Rotating Graphics!
- More Summer Project Winners

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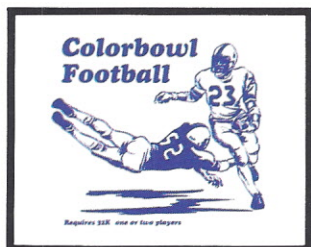
Poor Jr must overcome four screens to rescue The King from Luigi. Traverse the jungle & swamp, climb vines, avoid vine gators, dodge Zuzu birds, open locks, & conquer Luigi's hideout.

32K C \$28.95 32K D \$31.95



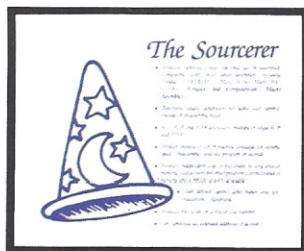
Use speed, skill, & concentration to race your car over the track, dodge competitors, & beat the clock. Taste the road dust, smell burning rubber, feel the press of speed on your chest!

32K C \$21.95 32K D \$24.95



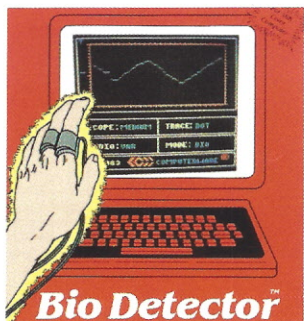
Big league graphics! Two players against each other or one can practice offense against the computer. 7 defensive & 8 offensive plays plus many formations.

32K C \$26.95 32K D \$29.95



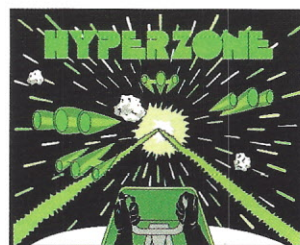
This menu driven symbolic 6809 disassembler produces symbolic source code that can be assembled. Automatic equate generation. FCC, FCB, & FDB generation. Written in position independent code, it is relocatable to any memory area. User defined symbol/label area. Produces files with or without line numbers. Can symbolize all extended addresses if desired. Written in assembly language for extreme speed. Disassemble to disk or cassette, printer, or screen.

16K C \$34.95 16K D \$39.95



A serious health aid for biofeedback training & a fun family game for "truth detection"! Real silver velcro finger grips attach to the detector box that plugs into the joystick slot. Now watch & listen to the galvanic skin response being graphed on the screen. An impressive experience for a friend who asks "what does your computer do?" All hardware, Bio Feedback program & Anxiety Attack game included. (Results not admissible in court!) (Req. 16K)

\$34.95



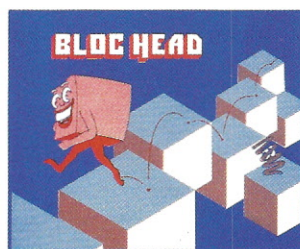
From the cockpit of your ship, see the real 3-D field of hyper space. Dodge oncoming space debris & destroy attackers as they whiz past. A new dimension in space games!

32K C \$26.95 32K D \$29.95



Travel through different time zones, fending off attacking craft from each period with a full 360 degree firing range. See blimps, helicopters, & all kinds of space vehicles.

32K C \$26.95 32K D \$29.95



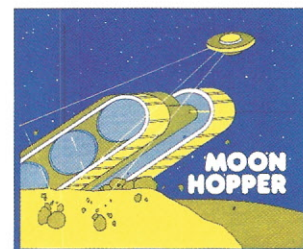
He jumps across pyramids of brightly colored cubes, dodges springs & bad eggs, using elevator squares, & gaining points as he clears the cubes towards the next screen.

32K C \$26.95 32K D \$29.95

Flexi Filer

Comprehensive & flexible data base manager. Collect up to 35 fields with up to 240 characters per record using your own names & format. With logical operators select any subset of records using up to 36 different criteria. Sort all or any subset of records in ascending or descending order on any of the 35 fields, with a fast assembly language sort. Design customized labels & reports with automatic page numbers, page headings, & totals of numeric fields.

32K D \$64.95



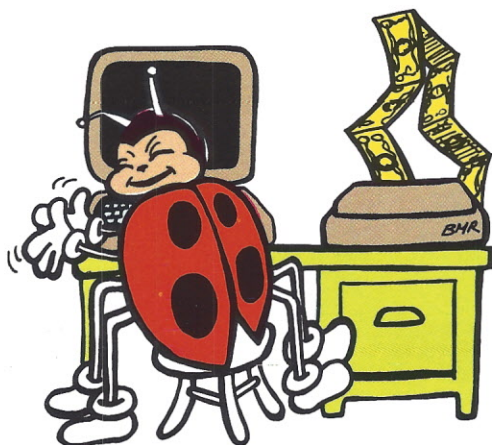
Your landing craft rolls over the surface with its tractors, hops over craters & rocks, & phasers attacking aliens to get to home base. Super graphics & sound!

32K C \$24.96 32K D \$27.95

Color Basic Compiler

For programmers who want the speed of assembly language & the ease of BASIC. 48 commands & functions, most a subset of Extended BASIC. Generates position independent code so a compiled program can reside anywhere in memory. When the compiler converts your BASIC program into machine language, it will run an average of 40 times faster!

32K D \$39.95



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Color Power II

Expands Your CoCo to CP/M

COLOR POWER II FEATURES

```
01 POWERFUL FOUR MHz Z-80A
02
03
04 HIGH QUALITY COMPOSITE VIDEO CIRCUIT USING A MOTOROLA 6845 TO GENERATE AN 80
05 COLUMN BY 24 LINE DISPLAY WITH UPPER and lower case characters ON YOUR
06 MONITOR (■■■■■■■■ ABCDEFGHIJ abcdefghijpqty %&$*+~/_-[]:;=?^.....
07
08 POWER SUPPLY INCLUDED
09
10 USES CoCo COMMANDS
11
12 RUNS THOUSANDS OF CP/M PROGRAMS
13
14 NO HARDWARE MODIFICATIONS NEEDED
15
16 NO NEW OPERATING SYSTEM TO LEARN SUCH AS OS-9, SDOS, FLEX, OR CP/M
17
18 NO NEED FOR A $180 EXPANSION INTERFACE
19
20 NO NEED FOR A $139 80 COLUMN BY 24 LINE BOARD
21
22 *** THIS IS AN ACTUAL COLOR POWER II DISPLAY ***
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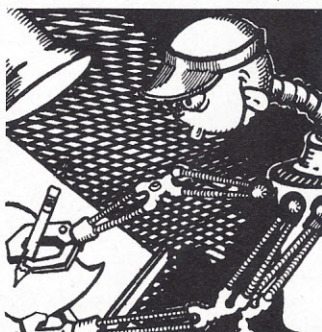
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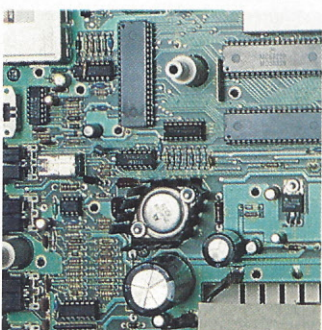
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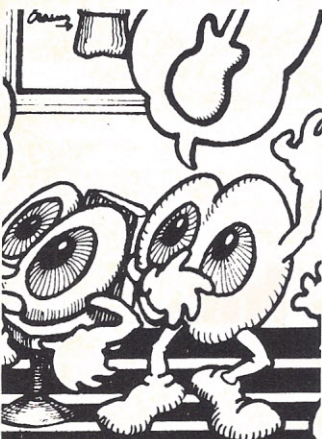
p. 65



p. 78



p. 95



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FEATURES

- 12/Speller** by Gerald Wegner (Education)
Practice your spelling!
- 14/Remote Override** by Larry Landwehr (Hardware)
Cut down on typing.
- 18/Databasing** by Terry Kepner (General)
A look at what it is, and what's available.
- 27/Cashbook** by D. E. Wood (Home Management)
A simple cashbook application.
- 40/More Summer Project Winners** (Game)
Here's the Grand Prize winner in Basic — Spazmorg!
- 54/CCTerm** by Richard Campbell (Utility)
You have an inexpensive terminal at your fingertips.
- 62/Videotex** by Steve Wegert (Hardware)
A quick trick with scotch tape.
- 65/Disk Secrets** by William Barden, Jr. (Tutorial)
Part II of a disk primer.
- 72/Explaining Color Basic ROM** by James A. Sanford (Tutorial)
Part I of a detailed explanation.
- 78/Modified Basic DBM** by Charles Jefferson (Upgrade)
Upgrading Detwiler's original.
- 87/Color Computing For Kids** by Jean Plessier (Education)
If...Then...Else.
- 94/Morse Code Generator** by Stephen Ritger (Utility)
Dits and dahs on your TV.
- 95/Dissecting Your ROM** by Jake Commander (Utility)
Part seven — The end of Standard Color Basic.
- 106/3-D Graphics!** by Dale A. Keller (Graphics)
Really, truly 3-D — with rotation!
- 125/Custom Color** by Dennis Kitsz (Utility)
Part I of The Color Burner. Part II will appear in May.

DEPARTMENTS

4/PEEK

10/INKEY\$

52/GOTO SCHOOL by Dr. Paul Kimmelman

120/DEFUSR by Terry Kepner

134/REVIEW\$

OS/9, Worksaver, Basic Aid, and more!

156/NEW:PRODUCT\$

158/FOR...NEXT (04,84)

160/END OF FILE

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"Superman" by Charley Freiberg; body and visage by Mike Federle

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CoCo FLEX or OS-9 \$59.95

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CoCo OS-9: \$49.00

Standard OS-9: \$99.00

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With Source:

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ommunications are a part of everyone's life. You can't function in our society without communicating in some fashion with untold numbers of people. Communication does not have to be verbal — it can be a gesture that two people understand, it can be written characters of an alphabet, it can be a numerical equation, or a physical or drawn symbol with meaning — the only real limitation is that whatever passes for communication must somehow originate from one source, be received by another, and must have the same meaning for both. Otherwise, communication does not exist, or fails.

How one communicates depends on many factors — to whom you wish your message to go, how many other folks you want to receive your message, how far from those folks you are, whether they speak the same language, whether you or they are physically handicapped, how fast you want your message to be received, whether you want acknowledgement of reception, and so forth. Communication also can be one way or two ways — a message sent and received, or a message sent, received, and generating a response.

Computer technology has opened up a whole new method of communications for those of us lucky enough to be in the field. Communications via microcomputer — and usually modem and telephone line — is now one of the fastest, most reliable, and accurate ways to transmit a message (data). It cuts through the barriers of time, distance, physical abilities, and language barriers with ease. It opens one to receive from or send messages to any number of people at one time, in one step — sometimes even in our absence. To folks living a century ago, communications via computer would seem very close to a miracle.

This issue begins the first of three issues in which we will look at computer communications. This month our theme articles will deal mainly with those communications that take place over the telephone lines. Next month we'll look at robotics — how man communicates with a machine through his other machine: the microcomputer; in May, we'll look at computer languages — how we communicate with our micro.

First GOTO 18 to learn what databasing is, and to discover what databases are available to micro users. Terry Kepner

gives us a good overview, and sources to discover even more. GOTO 54 to learn how to turn your Color Computer into an inexpensive terminal. Then GOTO 62 to discover how a piece of scotch tape can make your videotex program do things it can't do!

Part II of Bill Barden's primer on disks — what they are, how they work — can be found if you GOTO 65. From there, GOTO 125 for part one of Dennis Kitz's EPROM burner: Color Burner. Dennis has some April foolishness planned for next month, so part two will not appear until May. At that time, Clement's alternate EPROM burner method, originally promised for this month, will also appear.

The end of Jake's disassembly of Color Basic has finally arrived (GOTO 95); he will begin disassembling Extended Color next month. To help you folks who didn't find Jake's explanations long or detailed enough for your purposes, GOTO 72 for part one of James Sanford's longer explanation of Color Basic ROM.

Now let's take a break from the hard stuff and GOTO 40 for some fun: "Spazmorg," by A.E. Bogdan, was the Grand Prize Winner in the Basic category of the Summer Programming Project. It's a great game.

GOTO 12 for a simple program that will help your students practice spelling; GOTO 87 for this month's installment of Color Computing For Kids, that includes a special St. Patrick's Day game; and GOTO 52 for the latest news from the educational scene, with Dr. Paul Kimmelman.

Remember Detwiler's Basic DBM article (March, 1983)? GOTO 78 for a modified version with additions.

Having trouble keeping your accounts straight? GOTO 27 for a solution. Tired of typing all those commands? GOTO 14 for a quick end to one lengthy command series.

Now let's have some real fun. We've all wondered why our nifty little machine couldn't do some of those wonderful graphics its bigger brothers seem to do so easily. Well — we were all wrong. *Our* nifty little machine *can* draw a three-dimensional object and rotate it on its axis. Granted, it has to think about it a little longer than its bigger siblings might, but — well, GOTO 106 and see for yourself. I promise you, the relatively short wait is well worth the results!

—D.M., Editor

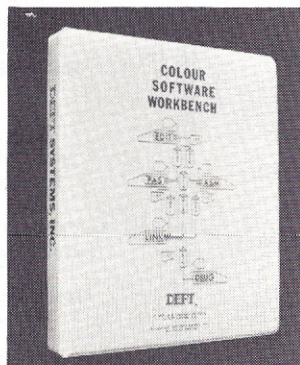


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The **Colour Software Workbench (CSW)** is a system of **machine language** programs that run on a 32K or 64K TRS-80 Color Computer Extended Disk Basic System. It lets you develop machine language programs in a combination of **Pascal** and **6809 Assembler** source languages. The **240+ page CSW User's Guide** that is included explains the fundamentals of the languages as well as how to use the package.

Part ONE of the CSW User's Guide tells you how to use all of the programs in the Workbench. This first part contains one section for each program.



TEXT EDITOR

- Screen Mode Editing
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- Reading, Writing and Merging Files From Tape and Disk

PASCAL COMPILER

- Specifying:
 - Source from Tape, Disk or Keyboard
 - Object and Listing to Tape, Disk, Screen or Printer
- Optional Symbol Table in the Object File for use by the Symbolic Debugger
- Explanation of Source Listing Format

MACRO ASSEMBLER

- Specifying:
 - Source from Tape or Disk
 - Object and Listing to Tape, Disk, Screen or Printer
- Explanation of Source Listing Format

OBJECT LINKER

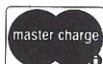
- Specifying:
 - The Machine Language ORIGIN
 - Listing to Tape, Disk, Screen or Printer
 - Binary File on Disk
 - Whether to use Pascal Runtime Library
 - Whether to use Symbolic Debugger

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- Displaying and Modifying 6809 and Graphics Registers
- Displaying and Modifying Memory
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Part TWO of the CSW User's Guide provides you with the background information needed to write programs using the Colour Software Workbench.

LEARNING EXERCISE

- Complete Pascal and Assembler Language Source
- Uses All Parts Of the Workbench
- Resulting Program is a Text Processor

PASCAL

- Describes Standard Language Elements Supported
- Constants Include Decimal and Hexadecimal Integers, ASCII characters and strings
- Types Include:
 - Integer, Char, Boolean, Enumerated, Subrange
 - Multi-Dimensioned Arrays
 - Records and Variant Records
 - Sets of Up to 256 Elements
 - Files
- PROCEDURES and FUNCTIONS with FORWARD
- Variables and LABELS
- Arithmetic, Boolean, and Set Expressions
- Statements: IF, WHILE, REPEAT, CASE, GOTO, EXIT, FOR, BEGIN, assignment (:=)
- Input/Output: RESET, REWRITE, READLN, EOF, WRITE, WRITELN, CLOSE, PAGE
- Built-in Functions and Procedures: ABS, CHR, CURSOR, ODD, ORD, PRED, SUCC

ADVANCED PASCAL

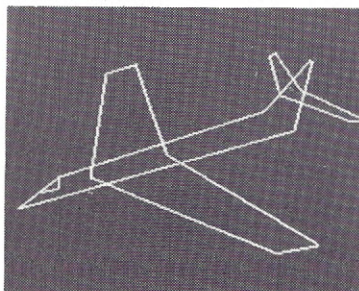
- Strings Support: Assignment, Comparing, Concatenation
- String Procedures and Functions: STRINGCOPY, STRINGDELETE, STRINGINSERT, STRINGPOS, HEX, ENCODE, DECODE
- Type Extensions for Structured Type Breaking
- Absolute Memory Access via Built-in WORD and BYTE Arrays
- ROM Routine Access via CALL Built-in Function
- Static and Public Variable Allocation
- Separate Compilation and Assembler Interface via INTERFACE, EXTERNAL, and PUBLIC
- Listing and Multiple Source File Directives
- Explanation of Error Messages

6809 MACRO ASSEMBLER

- Motorola Compatible Source Conventions
- Macro Facility With up to 9 Macro Parameters
- Separate Compilation and Pascal Interface via PUBLIC and EXT Directives
- Listing Control Directives
- Explanation of Error Messages

TECHNICAL NOTES

- CoCo ROM Compatibility
- Pascal Runtime Library Assembler Interface
- CSW Object File Format



Hi-resolution and 3-dimensional skeletal **graphics** packages included. This includes full Pascal & Assembler source code. Includes: HIRESCLR, HIRESLINE, GRAPHDISPLAY, MOVESKELETON, SHOWSKELETON

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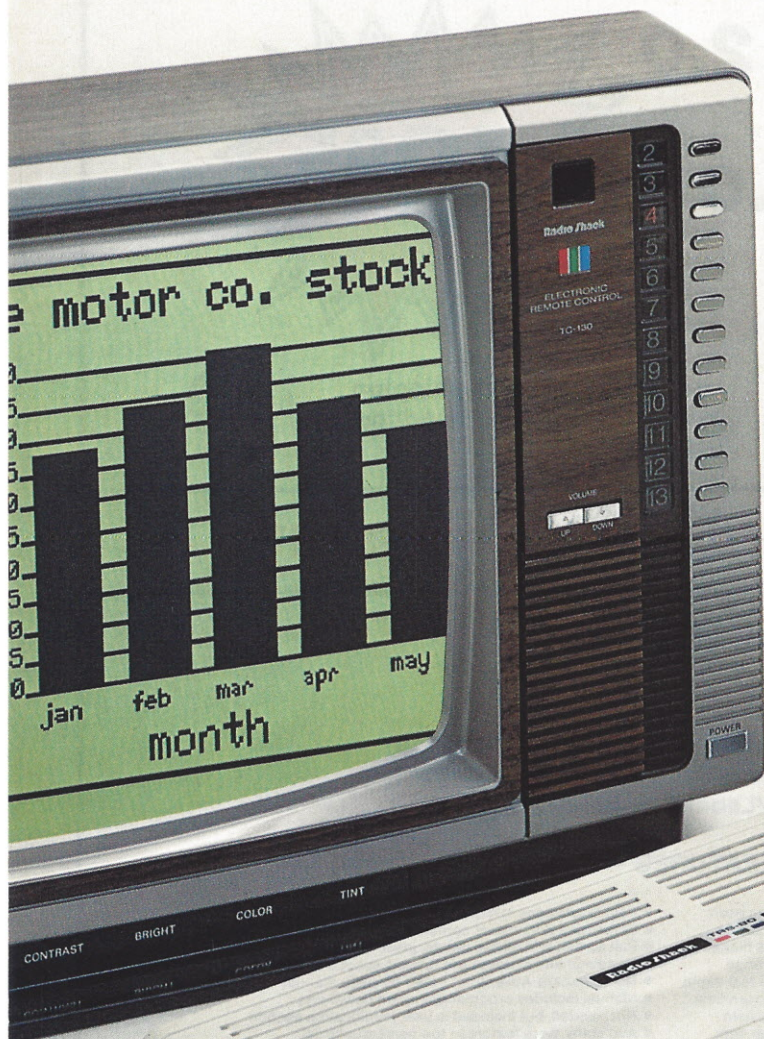
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The Color Computer Magazine
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New Fit for Slither

I am glad to see more assembly language programming showing up in your magazine. Stephen P. Allen's "Slither" was a lot of fun. It fits very well into my 16K Color Basic machine by changing only the ORG to \$3300 and the SETDP to \$33. Just insert the EDTASM+, type in the program with the two changes, and assemble A/IM/AO. To run the program, enter GSTART from ZBUG. To save it, type P SLITHER 3300 38AC 331A.

From then on it can be CLOADed and executed from Basic.

Richard Martin
Raleigh, N.C.

Fix and Change

In your November issue you printed a program called "Slither." The heading said the program was for Extended Basic. However, by changing a few lines it will run on Non-Extended Basic. Also, the program had an error.

These are the lines for Non-Extended Basic:

```
Omit 4050
1040 Print @LL, "Score = " SC
"Crashes Left = " CT-CS;
4110 Print @LL, "Score = " SC
"Crashes Left = " CT-CS;
5010 Cls:Print @ 167, "Your score
was " SC;
5020 Print @ 231, "High Score = "
HS;
```

To fix the error type: 499 GOTO 4000.

It is my theory that a few lines could be inserted at the beginning of a program so that Extended Basic commands could

be used on Non-Extended Basic. For example:

```
Draw = POKE n,x
Line = POKE n,x etc.
```

Also I agree with one of the letters in your column. I also would like assembly language for the beginner. I am 14 years old.

Lee Helton
Brashear, MO

News Needed

Paging through the last issue of **The Color Computer Magazine** I see a high quality publication that certainly knows where it stands. I feel you have done a great job in forming the magazine and in creating your own style. Now I am starting my own free newsletter. As the newsletter's editor, I am asking for submissions from **The Color Computer Magazine** readers. All submissions will be printed.

Matthew Kurzawa
Parlin, NJ

Simplification

I am impressed with the series called "Graphics? Yes!" in the last two issues of **The Color Computer Magazine**. I feel one important item should be added. There is an undocumented command available from Draw mode that can make it easier to use. Remember the X; command? The variable between the X and the semicolon is used as if it were a part of the Draw string.

If you want to do the same thing with numeric variables use the =; command. The variable between the equals sign and the semicolon is used just as if it were part of the Draw string. Using this command means you don't have to convert numbers with the STR\$ command to add them to the Draw string.

Here is an example:

```
10 PMODE1,1
20 PCLSO
30 SCREEN1,0
40 FOR N=0 TO 3
50 DRAW"BM128,96;A=N;
   C=N;U88;"
60 NEXT
70 GOTO 20
```

This will draw a four color cross on a red background. You cannot see the top line of the cross because it is the same color as the background. In the example, the variable N indicates both the line color and the direction it is drawn.

The =; command can be used in the same way in the Play mode using the same syntax. It

eliminates many lines of unnecessary code converting numbers to strings.

Rex Rivers
Via CompuServe

Joystick Adaptation

I loved "Slither" (November, 1983) so I programmed the game so you can play with the joystick. Note: This is not the machine language version.

Add these lines:

```
501 UP=JOYSTK(0)
502 LT=JOYSTK(1)
510 IF UP<2 THEN DY=-1:C=1
520 IF UP>1 THEN DY=1:C=1
530 IF LT<2 THEN DX=-1:C=1
540 IF LT>1 THEN DX=1:C=1
```

Andy P. Oikle
Westborough, MA

Basking in Info

I remember the dark days when the Color Computer came out and there was hardly any source of information about it. I spent many hours (which I enjoyed), wondering what made it tick, trying to get the info out of a sometimes unyielding *Getting Started With COLOR BASIC* from the Shack.

But now I marvel at what's in your magazine, from Barden to Kitsz; even the ads are instructive (not to mention the Map!). I recommend you to my friends, and am upgrading through one of your advertisers.

Terrence R. Settemtue

Southern Software Answers

Thank you for your thoughtful review of the Bar Zapper in the December 1983 issue of **The Color Computer Magazine**. In all respects the review gives an accurate report of the capability of the Bar Zapper. However, the one "drawback" mentioned in the review is actually a significant feature. The so-called drawback is the fact that a screen print program is not included. If a screen print program were included, it would likely be one compatible with Radio Shack printers. This

Bulletin Boards

California

Falcon Color-80, is on-line 24 hours a day in California with an electronic mail section and full upload and download capabilities. Write Craig, Keith and Dan Daniel, Sysops, Falcon Color-80, P.O. Box 2936, Fairfield, CA 94533, for more information, or call (707)437-3663.

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would eliminate all the Color Computer owners who have other kinds of printers.

To solve this problem we recommend our customers obtain the necessary print program from Custom Software Engineering (807 Minutemen Causeway, Cocoa Beach, FL 32931). Custom Software Engineering has a screen print program for many printers including Radio Shack. Finally, we pro-

vide detailed instructions on how to interface the screen print program so that a single keystroke gives an automatic print-out of the displayed graph.

So, what at first glance appears to be a limitation is part of how we are able to satisfy all those folks who don't have "pure" Radio Shack systems.

Thomas J. Ernst
Merritt Island, FL

Star Fix

As "Star," by David Lauter, appears in the November issue, a syntax error occurs in Line 30. If you delete the two asterisks in Line 30, "Star" will work correctly.

David M. Lauter

Clubs

Kirkville, MO

For information send a self addressed stamped envelope to Mike Galletly, 703 College Park Dr., Kirkville, MO 63501.

Ontario Club

Meadowvale Color Computer Club meets on the first Thursday of each month at 6:30 p.m. For more information write the club, P.O. Box 186, Streetsville, Ontario L5M 2B8.

Huntsville, AL

The COLOR80 Users Group has been organized in Huntsville, Alabama. For more information call (205)882-2485 or write Randy Niemann at 10111 Versailles Dr., Huntsville, AL 35803.

Toledo, OH

The Greater Toledo Color Computer Club meets the first Thursday of each month at 7:30 p.m. in the Wernert Civic Building, on Douglas North of Laskey, in Toledo, Ohio. For information call 478-6961 or 537-1432.

Peoria Club

The Peoria Color Computer Club meets on the second and fourth Saturdays of each month at 10:00 a.m. at the Germantown Hills Fire Station in Germantown Hills, Illinois. For further information contact Harold E. Brazee at 102 Twin Oaks Ct., East Peoria, IL 61611 or call (309)694-4703.

Montreal Users Group

Montreal TRS-80 Users Group may be contacted at 1176 Phillips Place, Suite 201, Montreal, Quebec, Canada H3B 3C8. Member benefits include down-time service which entails use of another member's equipment as long as his/hers is indisposed; purchases through the club charged at a discount; Bulletin Board System, which includes a classified ad department and electronic mail; advertising accepted at a nominal rate; and free subscription to a bi-monthly newsletter.

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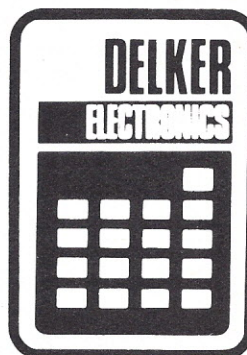
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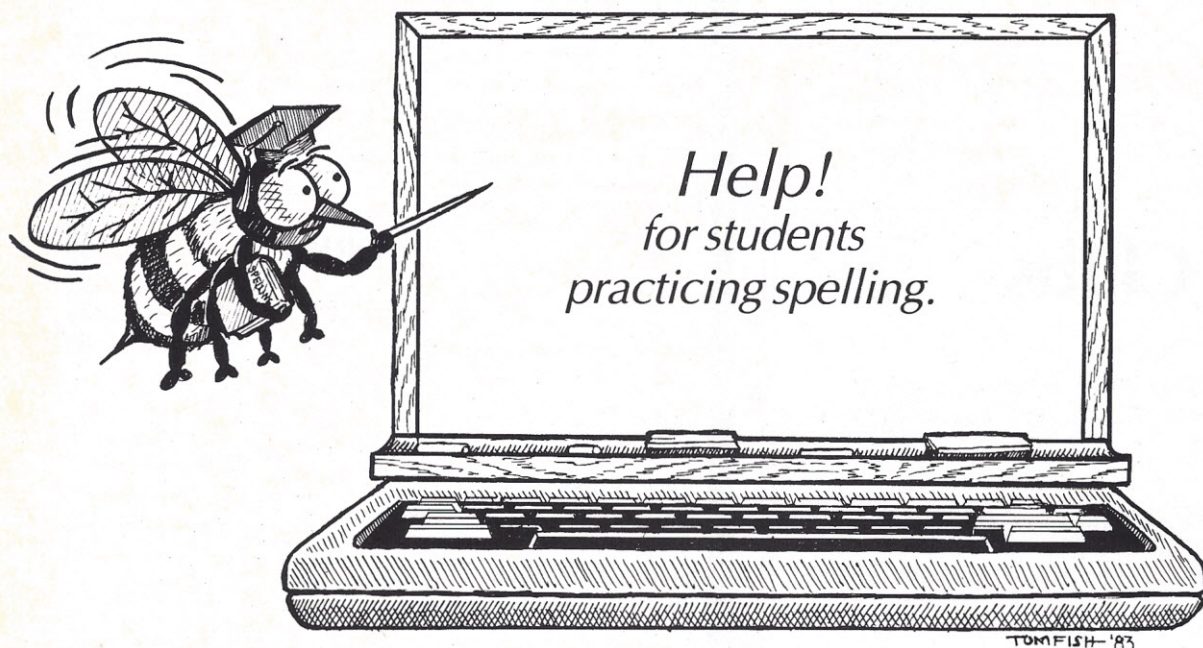


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Speller



4K Color Basic

LAST WINTER MY YOUNG DAUGHTER wanted to get into the spelling bee at school. I had just 4K of memory and a cassette recorder for I/O, but I decided this should be enough. In fact, I made it a condition for buying more equipment: if this application didn't work on my small machine, I was not going to buy anything else; but if it worked out well, I would purchase more. I now have several small computers, and my largest Color Computer has 4K.

The program is necessarily a bit crude, but considering there is no extra hardware and that it takes less than 4K of memory, one is hard pressed to do much better.

There are two modes of program operation: the Input mode, and the Test mode. After loading the program and entering RUN, the program queries, WHAT IS YOUR NAME?. If you push the Enter key the program goes into Input mode; any other entry puts it into Test mode.

With the program in Input mode, put a freshly erased tape into the cassette recorder and place it in record mode. The program will prompt ENTER WORD. At this time, key in the word you want spelled —

by Gerald Wegner

just make sure you spell it correctly! Next the program will prompt WHEN READY TO TALK PRESS THE SPACE BAR. This is the tricky part: pull the computer's plug out of the MIC jack (and insert a microphone if the tape deck doesn't have one built-in), press the space bar, and say "Spell the word x," where x is the word you want spelled (the same word(s) you entered above!).

After you have pressed the space bar, the numbers from 1 to 333 will be displayed on the CRT. Be sure to leave enough silent time between words so the user will have time to type or spell the words you've recorded. After you have recorded the word to be spelled, put the plug back into the recorder. When the program prompts you to continue, press the space bar. The program will now prompt you to type in a word. This sequence will be repeated until you press the Break key. I have loaded several tapes with a hundred and one words using this

program, and had no trouble after I got used to the procedure.

Initially try a few easy words in the Input mode, then return to the Test mode, rewind the tape and act as the user. This lets you check for a bad tape and redo it easily.

If anything other than the Enter key is entered at the initial query, the program assumes the entry is your name, and will use this name several times as you cycle through the program in Test mode. In Test mode, the tape with the words previously entered (via the Input mode) will be played through the TV speaker. The program will count from 1 to 330 on the TV screen during the time "Spell the word x" is spoken over the TV speaker. The program then prompts the user: SPELL IT.

The program will check the spelling against the words you typed in. If it is not correct, the program will tell the user the spelling is incorrect, and prompt him to try again. It will repeat this five times, then it will spell the word correctly on the screen.

If the word is spelled correctly, the program will prompt: GOOD and then continue to the next word. ■ ■ ■

Program Listing: Speller

```

1 REM SPELLER PROGRAM
10 CLS(0)
20 MOTOR OFF
30 TT=5
40 INPUT"WHAT IS YOUR NAME";N$
50 IF N$ <> "ENTER" GOTO 150
60 INPUT"ENTER WORD";W$
70 MOTOR ON
80 SOUND 130,1
90 OPEN"O",-1,"WORD"
100 PRINT#-1,W$
110 CLOSE-1
120 SOUND 230,1
130 GOSUB400
140 GOTO 60
150 OPEN"I",-1,"WORD"
160 INPUT#-1,W$
170 CLOSE-1
180 AUDIO ON:MOTOR ON
190 FOR XX=1TO330
200 PRINT XX
210 NEXTXX
220 MOTOR OFF:AUDIO OFF
230 T=0
240 CLS(RND(8))
250 PRINT"SPELL IT"
260 AUDIO OFF
270 INPUTX$

280 IF X$=W$ THEN GOTO 370
290 SOUND 50,1:SOUND 1,2
300 T=T+1:IF T>TT THEN GOTO 330
310 PRINT"NO, ";N$:PRINT"TRY AGA
IN"
320 GOTO 250
330 PRINT N$;"," THE WORD IS"
340 PRINT "SPELLED " W$
350 INPUT"PRESS THE SPACE BAR TO
CONTINUE";S$
360 GOTO 150
370 PRINT"VERY GOOD "N$
380 FOR X=1 TO 3:SOUND 100,1:SOU
ND 100+10*X,1:NEXT X
390 GOTO150
400 REM
410 PRINT"WHEN READY TO TALK ";
420 GOSUB 490
430 MOTOR ON
440 FORXX=1TO333
450 PRINTXX
460 NEXT
470 MOTOR OFF
480 RETURN
490 PRINT"PRESS THE SPACE BAR"
500 A$=INKEY$
510 IF A$<> " " GOTO500
520 RETURN

```

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The Color Computer has a powerful ally in FILMASTR. This is a DATA MANAGEMENT SYSTEM that you can trust. FILMASTR combines the best features of the big systems to provide a combination of speed, power, and ease of operation that can't be beat.

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Enter data by just filling in the blanks. This form fill-in is easy and natural to use. You can even copy data from the previous record with one key-stroke. Add records, delete records, change records without fuss.

Tell FILMASTR to sort your file on any field that you want or to retrieve a particular record and the job is done with super-human machine language speed. FILMASTR will find a single record or a group of records that meet your request and will save those records as a separate file if you want to.

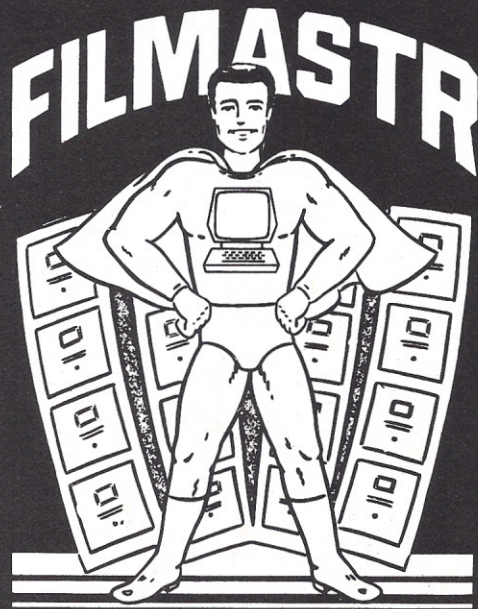
Controlled printing formats? Of course! Tell FILMASTR which records to use, which fields to print and in what order. You can control the print location to any position on the page. Mailing labels? You bet!

All commands are given to FILMASTR with single key strokes. Press the HELP key (BREAK), and the available commands are displayed. Make your choice from the menu and let FILMASTR do the work.

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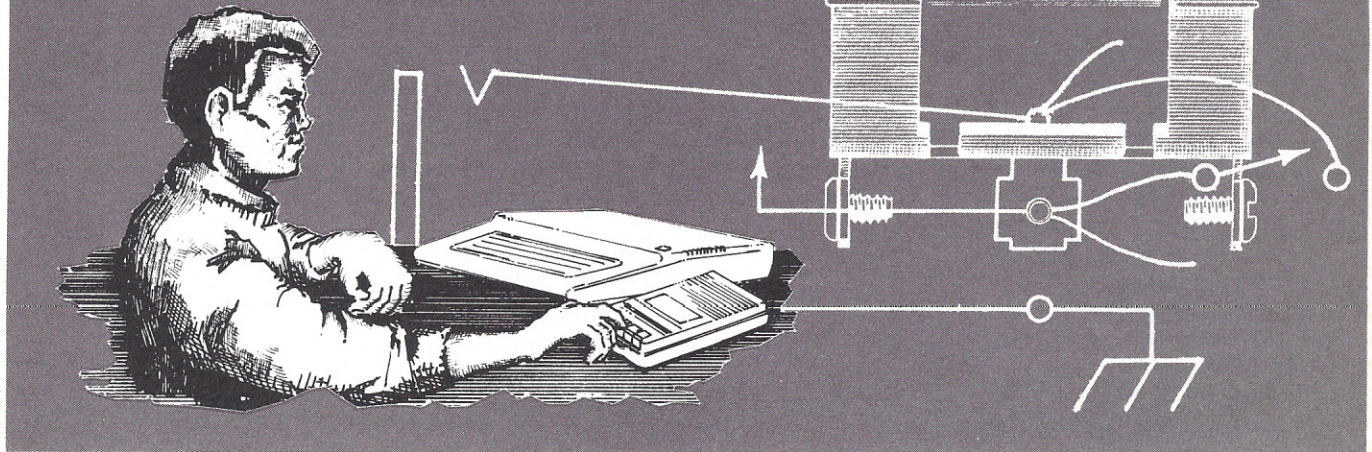


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Remote Override

How to avoid typing Motor On and Off commands.



HERE IS A NEAT modification you can make to your cassette recorder that will make it a lot easier to use. I changed mine about two weeks ago and wouldn't be without it now. This mod will let you rewind tapes without pulling the plug from the motor remote control jack or typing the Basic commands MOTOR ON or MOTOR OFF. It will let you erase tapes while programming. You will be able to play tapes and listen for the file leader sound (to locate files on a tape) more quickly, without typing MOTOR ON and AUDIO ON. All this will cost \$3.

The jacks (earphone, microphone and motor) in your recorder are switches. Normally they appear as in Figure 1. Inserting a plug changes them to Figure 2. The difference: a switch has been opened.

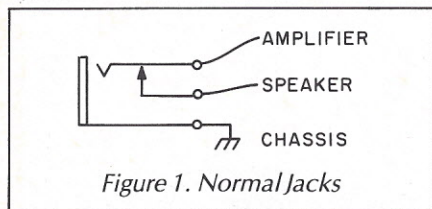


Figure 1. Normal Jacks

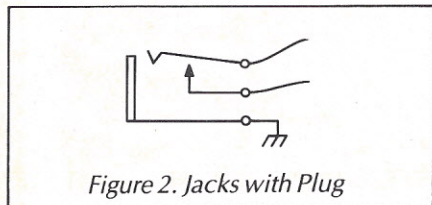


Figure 2. Jacks with Plug

by Larry Landwehr

If you were to take a piece of wire and connect it, as in Figure 3, on the remote motor jack in your cassette, the cassette will act as if no plug were present — this overrides the jack's switching action. If that piece of wire was a switch instead, as in Figure 4, you could selectively override the plug. Just a snap of the switch and you can rewind, play, or erase.

Making a similar change to the earphone jack will let the speaker operate while playing tapes. This gives you a quick way to position your tapes.

Another possibility is to modify the

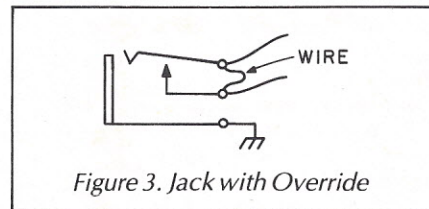


Figure 3. Jack with Override

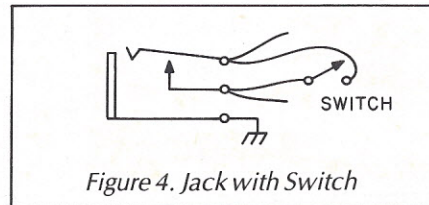


Figure 4. Jack with Switch

microphone jack. You could then put a voice message (e.g., the file name) before each file. This would permit super fast location of files on a multi-file tape.

My present configuration is to have the earphone and motor override switches ganged together. Both are overridden simultaneously (the other possibility, each independent of the other, seems to have no useful purpose). This is accomplished by using a double-pole, double-throw switch. These are available from Radio Shack or any electronics shop for about \$3. They come in a variety of shapes and sizes; the most useful are the miniature toggles rated at three amps.

Open your recorder and find the jacks. Wire the switch as in Figure 5. Hint: use a piece of wire to check your connections before soldering — it can simulate your switch.

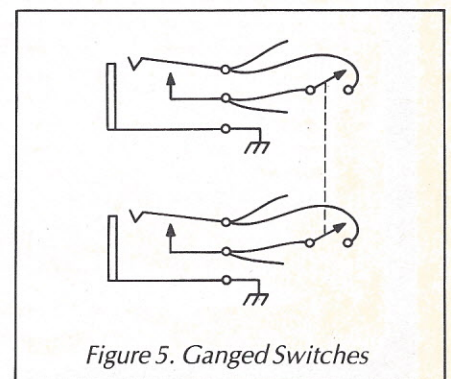


Figure 5. Ganged Switches

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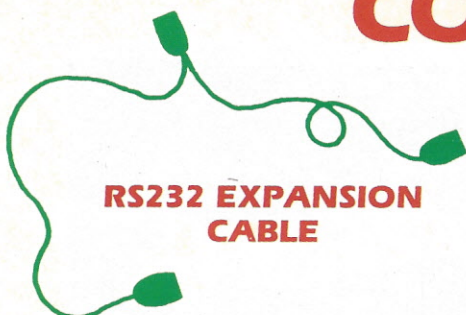
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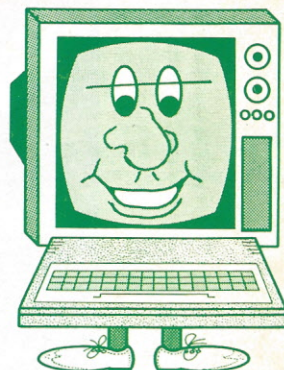
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Drive 0 System	\$349.95
Gemini 10x w/CoCo Interface	\$349.95
Telewriter 64 — Top CoCo word processor for	
two years! Three hi-res screens, true lowercase	
characters, right justification, full screen editor.	
Tape \$49.95, Disk \$59.95	

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THE SPECTRUM VOICE PA

A CoCo voice synthesizer, is a complete phoneme based voice system that uses the famous VOTRAX SC chip synthesizer in a cartridge shell. It provides an unlimited vocabulary with automatic or user supplied inflection, plus four programmable levels of pitch. With a single line code, THE VOICE PAK adds speed to any BASIC program in minutes. The system comes complete with user instructions, software cassette with 16K and 32K — DISK/TAPE versions, a text to speech scanner translator and a Word Manager that constructs and edits custom user dictionaries. The unit is fully assembled, tested and ready to plug in and to talk, talk. \$69.95

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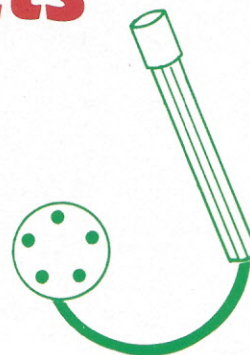
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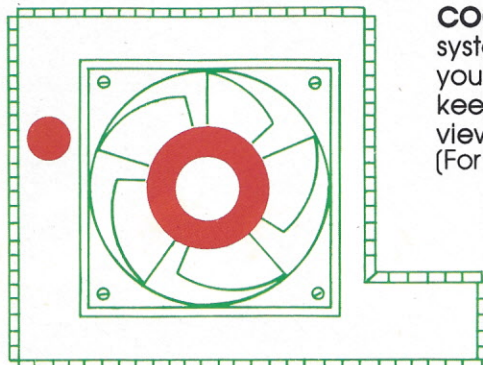
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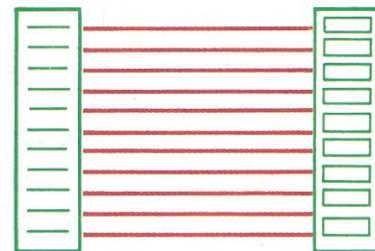
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DISK INTERFACE/ROM PACK EXTENDER — 3 FEET. Move your disks and ROM packs where you want them. Gold plated contacts eliminate corrosion. \$29.95

NEW! TAPE UTILITY by Thomas Oik

A powerful program that permits the user to easily maintain backup, and catalog both tape and disk programs.

1. TDR—Tape directory
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3. PTD—List tape directory to printer
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6. DTT—Copy file from disk to tape
7. TTD—Copy file from tape to disk
8. BAC—**Auto disk to tape backup**!

Cassette or Disk - \$24.95

64K DISK UTILITY PACKAGE

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64 Disk Utility Package - \$21.95
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Finally! A program written to protect your BASIC programs. HIDDEN BASIC 1.0 will modify your BASIC programs so these commands will not function:

CLOAD or CLOADM
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DEL or EDIT
LIST or LLIST

The protected copy is not a BASIC program anymore. It is a special machine language program referenced by the BASIC interpreter. Once protected by HIDDEN BASIC there's no way to undo it!
..... Tape \$19.95

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A dark background featuring a close-up of a black rotary telephone in the upper right corner and a white computer keyboard in the lower left corner. The telephone's dial is visible with numbers 1-9 and 0, each with corresponding letters. The keyboard shows keys for CLEAR, SHIFT, ENTER, and a key with a slash and question mark.

*The newest
and fastest way
to set up-to-date
info and make contacts.*

Databasing

by Terry Kepner

MOST COMPUTERISTS THINK of Online Computer Telephone Databases (OCTD) in terms of Dow Jones stock access or UPI News Reports, dismissing applications useful to general business and hobbyists. Unfortunately for these people, they're ignoring one of the hottest and most important aspects of computers in today's society. ♦ *more*

Telewriter-64TM

the Color Computer Word Processor

- **3 display formats: 51/64/85 columns × 24 lines**
- **True lower case characters**
- **User-friendly full-screen editor**
- **Right justification**
- **Easy hyphenation**
- **Drives any printer**
- **Embedded format and control codes**
- **Runs in 16K, 32K, or 64K**
- **Menu-driven disk and cassette I/O**
- **No hardware modifications required**

THE ORIGINAL

Simply stated, Telewriter is the most powerful word processor you can buy for the TRS-80 Color Computer. The original Telewriter has received rave reviews in every major Color Computer and TRS-80 magazine, as well as enthusiastic praise from thousands of satisfied owners. And rightly so.

The standard Color Computer display of 32 characters by 16 lines without lower case is simply inadequate for serious word processing. The checkerboard letters and tiny lines give you no feel for how your writing looks or reads. Telewriter gives the Color Computer a 51 column by 24 line screen display with *true lower case characters*. So a Telewriter screen looks like a printed page, with a good chunk of text on screen at one time. In fact, more on screen text than you'd get with Apple II, Atari, TI, Vic or TRS-80 Model III.

On top of that, the sophisticated Telewriter full-screen editor is so simple to use, it makes writing fun. With single-letter mnemonic commands, and menu-driven I/O and formatting, Telewriter surpasses all others for user friendliness and pure power.

Telewriter's chain printing feature means that the size of your text is never limited by the amount of memory you have, and Telewriter's advanced cassette handler gives you a powerful word processor without the major additional cost of a disk.

...one of the best programs for the Color Computer I have seen...

— Color Computer News, Jan. 1982

TELEWRITER-64

But now we've added more power to Telewriter. Not just bells and whistles, but major features that give you total control over your writing. We call this new supercharged version Telewriter-64. For two reasons.

64K COMPATIBLE

Telewriter-64 runs fully in any Color Computer — 16K, 32K, or 64K, with or without Extended Basic, with disk or cassette or both. It automatically configures itself to take optimum advantage of all available memory. That means that when you upgrade your memory, the Telewriter-64 text buffer grows accordingly. In a 64K cassette based system, for example, you get about 40K of memory to store text. So you don't need disk or FLEX to put all your 64K to work immediately.

64 COLUMNS (AND 85!)

Besides the original 51 column screen, Telewriter-64 now gives you 2 additional high-density displays: 64 × 24 and 85 × 24! Both high density modes provide all the standard Telewriter editing capabilities, and you can switch instantly to any of the 3 formats with a single control key command. The 51 × 24 display is clear and crisp on the screen. The two high density modes are more crowded and less easily readable, but they are perfect for showing you the exact layout of your printed page, *all on the screen at one time*. Compare this with cumbersome "windows" that show you only fragments at a time and don't even allow editing.

RIGHT JUSTIFICATION & HYPHENATION

One outstanding advantage of the full-width screen display is that you can now set the screen width to match the width of your printed page, so that "what you see is what you get." This makes exact alignment of columns possible and it makes hyphenation simple.

Since short lines are the reason for the large spaces often found in standard right justified text, and since hyphenation is the most effective way to eliminate short lines, Telewriter-64 can now promise you some of the best looking right justification you can get on the Color Computer.

FEATURES & SPECIFICATIONS:

Printing and formatting: Drives any printer (LPV11/VIII, DMP-100/200, Epson, Okidata, Centronics, NEC, C. Itoh, Smith-Corona, Terminus, etc).

Embedded control codes give full dynamic access to intelligent printer features like: underlining, subscript, superscript, variable font and type size, dot-graphics, etc.

Dynamic (embedded) format controls for: top, bottom, and left margins; line length, lines per page, line spacing, new page, change page numbering, conditional new page, enable/disable justification.

Menu-driven control of these parameters, as well as: pause at page bottom, page numbering, baud rate (so you can run your printer at top speed), and Epson font. "Typewriter" feature sends typed lines directly to your printer, and Direct mode sends control codes right from the keyboard. Special Epson driver simplifies use with MX-80.

Supports single and multi-line headers and automatic centering. Print or save all or any section of the text buffer. Chain print any number of files from cassette or disk.

File and I/O Features: ASCII format files — create and edit BASIC, Assembly, Pascal, and C programs, Smart Terminal files (for uploading or downloading), even text files from other word processors. Compatible with spelling checkers (like Spell 'n Fix).

Cassette verify command for sure saves. Cassette auto-retry means you type a load command only once no matter where you are in the tape.

Read in, save, partial save, and append files with disk and/or cassette. For disk: print directory with free space to screen or printer, kill and rename files, set default drive. Easily customized to the number of drives in the system.

Editing features: Fast, full-screen editor with wordwrap, block copy, block move, block delete, line delete, global search and replace (or delete), wild card search, fast auto-repeat cursor, fast scrolling, cursor up, down, right, left, begin line, end line, top of text, bottom of text; page forward, page backward, align text, tabs, choice of buff or green background, complete error protection, line counter, word counter, space left, current file name, default drive in effect, set line length on screen.

Insert or delete text anywhere on the screen without changing "modes." This fast "free-form" editor provides maximum ease of use. Everything you do appears immediately on the screen in front of you. Commands require only a single key or a single key plus CLEAR.

...truly a state of the art word processor... outstanding in every respect.

— The RAINBOW, Jan. 1982

PROFESSIONAL WORD PROCESSING

You can no longer afford to be without the power and efficiency word processing brings to everything you write. The TRS-80 Color Computer is the lowest priced micro with the capability for serious word processing. And only Telewriter-64 fully unleashes that capability.

Telewriter-64 costs \$49.95 on cassette, \$59.95 on disk, and comes complete with over 70 pages of well-written documentation. (The step-by-step tutorial will have your writing with Telewriter-64 in a matter of minutes.)

To order, send check or money order to:

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704 N. Nob Ave.
Del Mar, CA 92014

Or check your local software store. If you have questions, or would like to order by Visa or Mastercard, call us at (619) 755-1258 (weekdays, 8AM-4PM PST). Dealer inquiries invited.

(Add \$2 for shipping. Californians add 6% state tax. Allow 2 weeks for personal checks. Send self-addressed stamped envelope for Telewriter reviews from CCN, RAINBOW, 80-Micro, 80-U.S. Telewriter owners: send SASE or call for information on upgrading to Telewriter-64. Telewriter-compatible spelling checker (Spell 'n Fix) and Smart Terminal program (Colorcom/E) also available. Call or write for more information.)

Apple II is a trademark of Apple Computer, Inc.; Atari is a trademark of Atari, Inc.; TRS-80 is a trademark of Tandy Corp; MX-80 is a trademark of Epson America, Inc.



For example, did you know: There's a database devoted to environmental issues, which will keep you up-to-date on all aspects of pollution and the efforts to control it? There's a database that lists all the U.S. patents in several fields, so you can check to see if your latest brainstorm is unique, or to find a product your company can market? You can do your own airline ticket reservations and trip planning? You can access a university library at home? That you can leave your resume on-line so companies looking for employees can see it and contact you if they're interested? There's even a database of professional technical writers that you can search for just the right person to review your latest product (or create a book you want to publish, if you're a book publisher).

All these and over a thousand other databases are available to you through telecommunications. For the hobbyist, many of these databases are a goldmine of information, services, and like-minded *friends*! That's right, you can meet hundreds of people who share your interests without ever leaving the comfort of your home. And you can send messages and pick them up at any time that's convenient (well almost, since some databases restrict hobbyists to night and weekend use only). Databases provide all the convenience of a fraternity or club, without the normal limitations of location, time, or distance.

You can get almost instant help with any problem by just asking your fellow members for assistance (and if it's computer related, they'll probably know more than the salesman who sold you your equipment).

The list is almost endless, with special interest groups and databases for aviation, medicine, authors, programmers, cooks, golfers, educators, ham radio operators, literature, and literally dozens, if not hundreds, of other subjects.

Database services can be divided into four major categories: free public service

bulletin board/database systems; daytime business systems that cater to businesses and professionals, and charge accordingly; night- and weekend-only services for hobbyists; and 24-hour commercial services that charge different rates for prime time (usually 8 am to 5 pm) and non-prime time (nights, weekends, and holidays).

The hobbyist's systems are put together on equipment owned and operated by people who do it for the fun of it, or by businesses who want to make it possible to communicate with their customers and other interested parties who can't or won't call during normal office hours. Most of the time these systems are hodge-podges of whatever software and hardware is at hand, and almost always use microcomputers. Although small, these systems have a definite flavor and favor the personal tastes of the owner and/or operator. Generally they're more fun, and many aren't afraid to experiment with new ideas.

Access to the hobbyist systems is direct-dial. There's no charge for using these services, you pay only for the phone call. If the board is local, or not too far

Dialog, I can call them long distance from New Hampshire at about \$12 an hour through the Bell system, or call the Tymnet phone node in a nearby town and pay only \$2 an hour.

The night-only services are usually big daytime services that want to tap the night crowd and make some extra money rather than letting their computers sit idle half the day. To keep expenses down, they offer far fewer databases at night, usually only the most popular (this also keeps their day customers from switching to night use and cutting the service's daytime revenues). Most of these services have telephone network agreements, easing the user's phone bill.

The full-time services offer all their databases all the time. For efficient use of their computers (to discourage overcrowding during peak hours of operation), they charge one rate during prime time hours and another, lower rate the rest of the time. The prime time rate is based on the fact that many businesses use the service during the day, and are willing to pay a premium rate for fast responses. After business hours, however, the rate is lowered to encourage hobby-

**"These networks charge customers
a rate much lower
than time on AT&T's Bell system."**

away, this can be very inexpensive. If the board is across the country, the phone charges can start to look like the national debt.

The day-time only services are usually designed for specific industries or purposes, and the owners anticipate that only businesses or professionals will be using the service. These services are usually operating with large macro computers like the DEC-10s, or IBMs, so they charge their customers for the amount of computer time used during the call. As a result, customers pay not only a phone bill, but a connect charge, usually based on which database is being used by the customer.

To help keep the customer's phone bill down to reasonable levels (daytime is full-charge for your phone call, don't forget), many commercial services have agreements with one or more telephone networks such as Tymnet, Telenet, or GTE net. These networks supply local numbers (called *nodes*) in many cities, and charge customers a rate much lower than equivalent time on AT&T's Bell system. For example, if I want to log-on to

ists, or businesses with smaller budgets, to use the otherwise idle equipment.

An example of this is the recent rate changes implemented by CompuServe. They raised the night rate by a dollar an hour, and lowered the day rate by almost ten dollars per hour. Apparently so many people were using the system at night that idle periods were appearing during the day. With the new rate structure, many businesses that logged on at night have moved to daytime.

The full-time services are available through telephone networks, and at least two offer their own telephone network at no extra charge. If you live in one of the hundreds of cities with the service's nodes, the only charge is for your actual connection time on the service, which can be a real money saver over the course of a year.

Types of Databases

The databases themselves are divided into three types: full text; bibliographic; and informational. The full text databases are like a library with articles, docu-

ments, books, and stories retained in their complete form: nothing is left out. This is the most expensive type of database; the volume of information stored is tremendous, and is expensive to put into magnetic form. A particular article is located by searching the words in the title, the author's name, specific descriptive code words, or even the entire document, for matches with a list of words supplied by the user. When matches are found, you're notified how many times the matches appeared. If you want, you can read the names of the documents that matched and select those you want to read. This is the most comprehensive method of information searching, since the entire article can be scanned for matches. Its disadvantage is that the number of documents available is limited by the size of the total system, which in turn decides the cost of the service.

The bibliographic databases are a combination of a library catalog system and a Reader's Digest approach. The article title, descriptive words, and author's name are stored and used as search fields. The entire article is not available; *abstracts* (short condensations) of each article are maintained in storage. For the full text you are referred to the original published version, which many of the services will provide for a fee.

These services are slightly less expensive than the full text services, and cover a much wider range of material and subjects (since each entry is much shorter than the full text version), but are handicapped by the fact that someone has significantly shortened the original article into an abstract of generally only one or two paragraphs in length. In doing so, the abstractor may have eliminated your search word or phrase. Also, the abstract might not have been done well.

The final type can be regarded as a "just facts" database: the information stored is raw data, such as immigration records, population data, stock market performance records, and many other time-based sets of data.

Any database service can offer individual or combination of types of databases, depending on what group of users they want to attract.

For the hobbyist, the free databases are the most used aspect of telecommunications. Since these services don't charge for connection time, the only expense is the phone bill itself. There are hundreds of these public bulletin boards across the country, making them convenient and easy to use. The "homey" atmosphere of these small systems is also a powerful attraction, as is the subject matter. You can find a public bulletin board on almost any aspect of our soci-

ety, including match-making and alternative life styles. Most of these bulletin boards have free programs or databases written and compiled by the different members, which can be easily downloaded to any other member's computer. The disadvantage to these systems is that many of them are offered only during restricted periods of time, usually evenings, weekends, and holidays.

Businesses and professionals have even more services and databases available, especially since many services are designed for specific businesses. The only requirement for a business to use telecommunications is to decide on the cost-effectiveness of using the databases: the information or contacts received must be worth the expense incurred working the database service.

Businesses

While most businessmen and professionals use computers for word processing and running their business, they're missing out entirely on the computer's information-gathering aspect. Not many realize they can use their computer to get, analyze, and act on information before the competition. In the past, the only method of acquiring information was from periodicals.

With the proliferation of computers, and easy access to major databases via telephone, this has changed dramatically. Instead of waiting for industry specific publications for news (usually two or three months after the fact), you can call up the appropriate database for your industry and get the details of the latest developments only days, sometimes hours, after the fact. This is a potential that can make or break a company in today's fast-moving market.

Several stories circulating illustrate this. One concerns an investor approached by two inventors with a hot new product: digital laser disk audio re-

cording. The investor went to a market research firm to try to gauge the potential of this new technique. The research firm, in turn, called up the Dialog database service with their office computer. Searching the U.S. patent section revealed several patents on similar devices, and a search of the Adtrack section (a compilation of advertisements in 148 publications) garnered advertisements of a product similar to the device the two inventors had described. Total investment was several hours of time, with less than 20 minutes spent telecommunicating.

The investor went home happy because he hadn't wasted his money in a "new" product that wasn't, and the inventors went home, chagrined.

Another story involves a doctor, who had a patient with an unusual complaint. The doctor remembered reading something about someone with just the same symptoms. A search of Medline, a database of 3.8 million records of medical articles and reports, put her on the track to a possible diagnosis.

This type of activity is not at all unusual. Dialog, for instance, (a service mentioned previously) has over 200 different databases to choose from, which makes it the largest multi-database service around. And it's literally just a phone call away. Many other data services are on the market.

Tariff

Data services can also be a powerful political tool. The results of the recent break-up of AT&T are a prime example of this. As a consequence of the break-up, Southwestern Bell Telephone decided to enforce a "data communications tariff" on all telephone lines connected to a modem. This tariff was established in the late sixties by AT&T as a method of recovering their investment when they upgraded standard telephone lines to reliable computer communication standards. They invoked this tariff only with

◆ more





large companies, at least until now.

With the proposed break-up and subsequent loss of long distance revenue, Southwestern Bell decided to implement this tariff on all modem users, to the tune of a \$50 per month charge. This tariff was instituted apparently without the company's needing to upgrade the telephone lines being charged. Since most people who buy equipment that attaches to the telephone lines abide by the regulation that requests they contact the telephone company and report their new purchase, Southwestern Bell would immediately realize an increase of income in the thousands of dollars.

Businesses were, of course, quite upset; but hobbyists were really burned. Under the proposed standard, if you used your telephone with a modem, regardless of whether you used it once a month or every day, your bill would have this tariff attached. Considering the numbers of hobbyists with modems (hundreds of thousands) not a small amount of money was in question. Since many hobbyists couldn't afford the extra \$600 a year, they would be forced to give up their data communications. The tariff would probably also kill all hope of making home videotext operation inexpensive and convenient, not to mention crippling the University mainframe to home education field.

Southwestern Bell is the only one charging a tariff at present; the other telephone companies are waiting to see the results.

Congressional Representative Frank Potter, Chief Counsel to the House Committee on Energy and Commerce Committee, is a member of CompuServe and the Model 100 Special Interest Group (SIG). When he heard about the tariff he started the wheels moving to exempt private individuals from the charges. Hundreds of CompuServe members responded within a few days to his request for information and letters. It took only a few weeks to establish a nationwide organization that would have taken months to organize using more traditional methods. Information was collected and distributed as fast as it appeared. Interested parties signed on to catch up with current events and the present status of the battle, regardless of their physical location in the country or the time of the day. It now looks like private users and some businesses will be exempted from the tariff. The battle is still in progress at the time of this writing, with reports appearing periodically in the Telecommunications SIG.

Private computer telecommunications may be one way for the average citizen to fight the "big brother" syndrome of

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1 year (12 issues)	\$50.00	\$95.00
6 months (6 issues)	\$30.00	\$55.00
Single Issues	\$ 6.00	\$11.00

Calif. residents add 6% to single issues. First Class postage to N. Amer. included. Overseas add \$10 to subscriptions and \$1 to single issues. Sent AO rate. All back issues from July 1981 available—ask for list. Programs are for the Extended BASIC model and occasionally for disks.



Chromasette
P.O. Box 1087 Santa Barbara, CA 93102
(805) 963-1066

government and large corporations, using computers to wage the battle against bureaucratic computerization.

What's Available

Here's a list of the more popular services available:

BRS/After Dark, 1200 Route 7, Latham, NY 12100, (518)783-1161

With more than 20 databases and electronic mail service, BRS is advertised as "your own library at home." Databases include Books In Print and BioScience Information Service. Initial fee is \$50, hourly connection fees range from \$6 to \$15, with a \$12 monthly minimum. As its name implies, it's available only in the evenings.

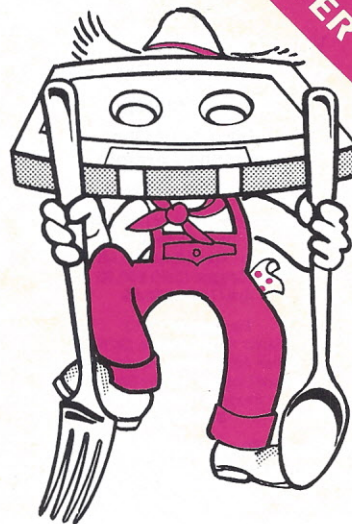
CompuServe, P.O. Box 20212, Columbus, OH 43220, (614)457-8600

CompuServe is geared more for providing services than databases. Specific application programs are supplied for purposes such as Fortran and Pascal programming, word processing, and cross assembling, for translating machine code programs from one computer processor to another (Z-80 to 6809, for example). Special interest groups are available for different computers, hobbies, and businesses; a special CB radio-type computer simulation (allowing large groups to communicate, like conference calls on normal telephones); on-line interactive games; news services; financial reports; and the Dow Jones service are only a very few of the over six hundred activities, databases, and services available. Initial fee depends on the options you chose: \$19.95 is the lowest priced, providing a user ID number and one hour of free time. For \$29.95 you buy the ID number, one hour of time, and the videotext program for your computer, if you have a Radio Shack TRS-80 computer. Another package includes the ID number and five hours time for \$39.95. On-line fees are \$6 for night and weekend use, and \$12.50 an hour for daytime use. Some services have extra fees for their use. Access is through Tymnet, GE Net, and free telephone lines in many major population centers. Principal users are hobbyists, businesses, and professionals.

Connexions, Professional Data Corporation, 55 Wheeler St., Cambridge, MA 02138, (617) 492-1690.

Connexions is a database of job openings. Interested people query the job database and then forward a copy of their resume to prospective employers. Over 100 high technology companies use this service. Connection rates are

TRS-80
COLOR
COMPUTER



TOOLS

Programs that make it easy to exploit the power and beauty of your Color Computer without making it hard on your wallet:

Graphics #1 - Displays and text delightfully manipulated! Watch and use First Cover, Drawer (the best drawing program anywhere), Graphtext (puts text on the graphics screen), Smalltext, Rotate (create and spin 3D objects in real time), World Map, 3D World, Star Map, String Art, Kaleidoscope, and Display Demo (text screen wizardry)!

Utilities #1 - Programming is simpler when you use Lister, Listmod, Newtrace (a better TRON), Lazkey (define keys as phrases), Append (easily combine two BASIC programs), BASIC Map, Varmap, Deleter, and CK Monitor (look at and modify memory).

Disk Utilities #1 - Harness the hidden powers of your disk system with Disk Edit (change things on disk directly), Disk Aid, Offset (EXECs most tape-only programs), Track Lock, DIR Save/Get (foil I/O errors), Cataloger, Master Catalog (keep track of your program library), an.1 File Copy (a better BACKUP).

Choose any one of the three packages for just \$12.00 (\$17.00 on disk)!

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Storm Arrow, Lancer (32K)
Gallax Attax, Lunar Rover (32K)
Ghost Gobbler, Whirly Bird Run
Froggie, Cubic (32K)
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Tom Mix Software

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Space Shuttle (32K) **\$28.95**
Trap Fall, Frog, Grabber (32K)
Buzzard Bait (32K), Cu'ber (32K)
\$27.95 ea.

VISA

Anteco Software

Pinball **\$24.95**
8 Ball **\$29.95**



Available in Rom Pac

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\$7.50 an hour, with full refund if a job is found through the service. Principal users are businesses and individuals.

Delphi, General Videotex Corporation, 3 Blackstone St., Cambridge, MA 02139 (617)491-3393

Delphi features electronic mail, banking, UPI newswire, airline information, a bulletin board, and Comp-U-Store. Initial fee is \$49.95, with on-line connection fee of \$16 per hour for prime time and \$5 per hour non-prime use. Nationwide access is through Tymnet. Principal users are hobbyists, but Delphi is now trying to attract more businesses.

Dialog Information Services, Inc., 3460 Hillview Ave., Palo Alto, CA 94304

A subsidiary of Lockheed, Dialog is a large collection of over 200 databases with half a million subscribers. The information is primarily abstracts of technical journals and government information. Keyword search functions let you examine the databases for mention of a topic or topics of interest. The search scans approximately 20,000 documents in under five minutes. Databases include Trademarkscan (600,000 trademarks as on file with the U.S. Patent and Trademark Office), MIDEAST File, and Medfile. No initiation fee is required, but the connection fees range from \$15 to \$100 or more per hour, depending on the databases being accessed. Principal users are researchers and businesses.

Dow Jones, P.O. Box 300, Princeton, NJ 08540, (609)452-2000

This is the Dow Jones Stock service, with information from the stock exchange floor delayed by 15 minutes. Databases include abstracts from the Wall Street Journal, Barrons, and the complete text of the Academic American Encyclopedia. Electronic mail and bulletin board are not yet supported. Initial fees are between \$50 and \$90, connection fees vary according to the database being accessed. Principal users are stock exchange businesses and some individuals. Also available through several of the other services listed here (CompuServe and Delphi are two).

Hutonline, E.F. Hutton, One Battery Place Plaza, NY, NY (212)745- 5000 5000

Limited to E.F. Hutton and their clients, Hutonline allows clients to access their account statements, make electronic mail transfers to their brokers, and gives access to investment databases created by the Hutton Research teams. Initial fee is \$25, and \$17 per month for unlimited use.

HRS:NET, 20 Park Plaza, Boston, MA 02116 (617)338-6313

The opposite of Connexions, this is an on-line resume service. You leave a brief resume of your qualifications on their database and prospective employers scan the list, then they use the electronic mail service to request that you send your complete resume to them. Principal HRS:NET users are freelance professionals and businesses.

Knowledge Index, Dialog Information Service, 3460 Highview Avenue, Palo Alto, CA 94304, (415)852-3901

This is a cut-down version (12 databases) of the Dialog service, operating during non-prime time hours only. Users are hobbyists and some businesses.

The KUSSMAUL Encyclopedia, General Videotex Corporation, 3 Blackstone St., Cambridge, MA 02139, (617)492-3393

A set of four services, the encyclopedia, Dow Jones, CompuServe, and Comp *U*Star. The encyclopedia has thousands of subjects, with updates daily. Principal users are hobbyists and businesses. KUSSMAUL is also available as a part of Delphi.

Medical Information Net, GTE Telenet, 8229 Boone Blvd., Vienna, VA 22180

The American Medical Association is sponsoring this as a physician's electronic mail service and bulletin board, with schedules of AMA meetings and continuing education. Initial fee is \$100 (\$75 for AMA members). Connection fees are \$8 per hour non-prime time, and \$16 for prime. The databases cost \$27 per hour.

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Online Computer Library Center, 6565 Frantz Rd., Dublin, OH 43017

OCLC provides bibliographic services for municipal, college, and private libraries. Principal users are researchers.

PhotoNet Computer Corporation,
500 Park Avenue, NY, NY 10022 (212)
750-1386

A service for photographers, advertising agencies, and publishers, providing electronic mail, bulletin boards, and an electronic magazine with news on the latest news, editorials, and opinion polls. Initial fee is \$100, connect-time fees vary according to database use.

The Source, 1616 Anderson Rd., McLean, VA 22102, (703)734-7500

The Source is geared more for providing services than databases. Specific application programs are supplied for purposes such as Basic, Fortran, and Pascal programming, word processing, and so forth. On-line program and data storage are provided, with access to financial news and other information available. Electronic mail is very simple to use, and popular. Initial fee is \$100, connect time fees range from \$7.75 off-hour to \$20.75 prime time. Extra fees are applied when using certain databases. Principal users are hobbyists and businesses.

Online Computer Telephone Directory, J.A. Cambron Co., P.O. Box 10005, Kansas City, MO 64111, (816)756-1847, CompuServe ID# 70040,414

This isn't a service, per se, but a newsletter listing all the current hobbyist bulletin boards in the country, with articles and reviews on communication programs, hardware, and services. For the most complete and up-to-date listing of "free" computer bulletin boards, this newsletter is the best buy. Principal users are hobbyists.

Directory of On-line Databases, Cuadra Associates, 2001 Wilshire Blvd., Suite 305, Santa Monica, CA 90403

Like the previous listing, this is not a database, but a directory of the available databases and services, having about 1700 entries. The subscription rate is \$75 per year (two directories and two update supplements).

Directory of Online Information Resources, CSG Press, 11301 Rockville Pike, Kensington, MD, 20895

Another publication covering the available databases, but less comprehensive than the previous listing. Single issues are \$22.50, a two year subscription (four issues) is \$60. ■ ■ ■

Eds. Note — Lawyers who are readers should note that there are at least two law databases available. Names and addresses should be available from the sources listed above.

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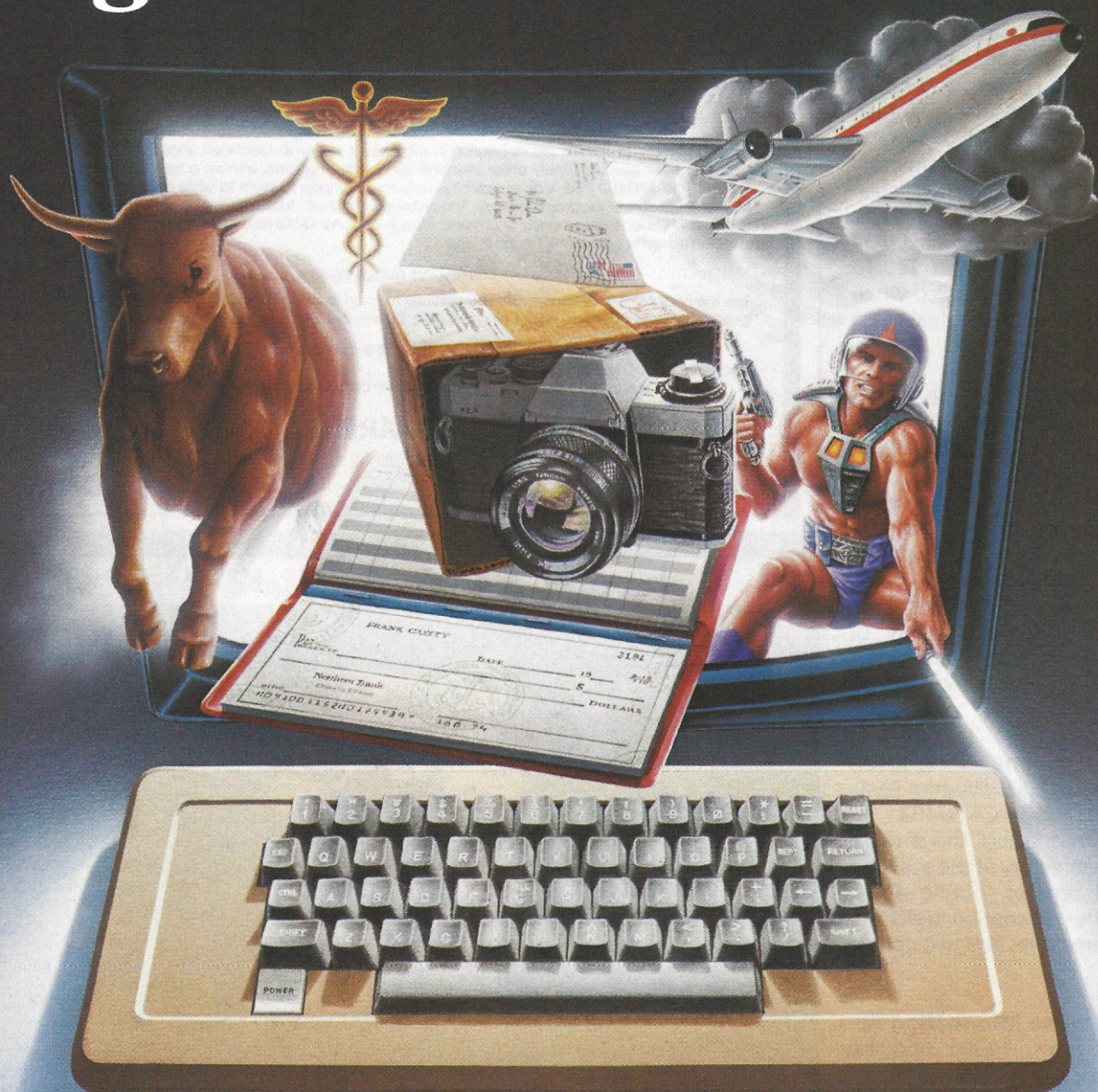
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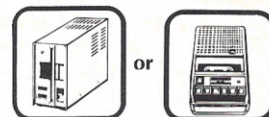
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Cashbook

*Here's a simple program
to use at home,
in your user's group,
or in any other club application.*

32K Extended Color Basic



I'VE SERVED AS TREASURER for several organizations, including our local users group. Since I dislike bookkeeping, but love playing with my computer, I've written a simple cashbook program which takes a lot of the drudgery out of record keeping.

CASHBOOK is a single-entry bookkeeping system — i.e., no debits and credits. Revenues are recorded as positive amounts and expenditures are shown as negative amounts. The user decides how many revenue and expenditure account codes are to be used, and chooses the account names. For each account the operator chooses a two-character abbreviation and a full descriptive name. The program uses the abbreviation to identify the account to which an item is charged. The full name is used for headings and for the statement of receipts and disbursements.

To produce a statement of receipts and disbursements, all the operator has to do is enter the time period covered by the statement. The computer does the rest.

CASHBOOK is designed for small organizations working on a cash basis, so there is no provision to produce a balance sheet or to record any assets other than cash. CASHBOOK's bottom line represents cash on hand, in the bank, or embezzled by the treasurer.

System Requirements

CASHBOOK is designed for a disk system with a minimum of 32K RAM. You could use this program on a cassette system if you modify the Load Data and Save Data routines (Lines 3000 – 4090) to use cassette input/output. CASHBOOK will not fit into a 16K system.

by D.E. Wood

```
< A >  ADD TO DATA ON FILE
< C >  CORRECT ENTRIES
< Y >  DISPLAY FILE ON VIDEO
< H >  HARD COPY OF FILE
< Z >  SAVE DATA TO DISK
< F >  FINANCIAL STATEMENTS
< S >  SORT INTO DATE ORDER
< I >  CHANGE ACCOUNT CODES
< B >  DESCRIPTION SEARCH
< T >  TEST FOR ERRORS
```

Photo 1. CASHBOOK Menu

Instructions for Use

● **Initialization** — When you run the program, it starts by showing the drive zero directory. That's for the benefit of us forgetful types who can't remember what data file name we used last. CASHBOOK then asks for a data file name. Let's assume we're initializing a cashbook for our local computer club, and enter CLUBCASH/DTA as our data file name.

The program then asks if this is the initial run for this data file. On future runs, just hit the Enter key in response to this query, and the program will proceed to load your data file. Since this is our initial run, respond with Y and CASHBOOK will ask you to enter the maximum number of account codes you require. You won't be able to change this in future, so leave yourself room for expansion. For purposes of our example, enter 20.

CASHBOOK then asks how many account codes are to be revenue accounts.

Again, leave yourself room for adding new accounts later. Let's enter 9. The other eleven accounts will be, by default, expenditure accounts.

You are then asked for the name of the organization. Type the name and press Enter.

The final step in the initialization process is to establish your account codes. You don't have to cover all possibilities here; you can add different account codes as you need them. You won't, however, be allowed to exceed the maximum number of accounts (20 in our example).

Continuing with our example, let's assume we want to start off by setting up two revenue accounts, *annual dues* and *bank interest*, and two expenditure accounts, *rent* and *newsletter*.

As soon as you enter the organization name, the computer will print out a reference number (from 1 to 20), the two-character abbreviation, and the complete account name for all 20 account codes. Since we haven't established any account codes yet, only the reference numbers will be shown on the screen. If you get a PRESS ENTER TO CONTINUE prompt, press Enter to get to the end of the listing.

In response to the ENTER ACCOUNT NUMBER query, enter 1. CASHBOOK will then print out the present data for account code 1, which in this case is nothing. It will then ask you for a new two-character code. Enter MF. For the new long description, enter ANNUAL MEMBERSHIP FEES.

CASHBOOK will again print out all the account codes, and ask you to enter a number. If you made an error entering the first item, enter 1 and re-enter the data for the membership fees. Other-

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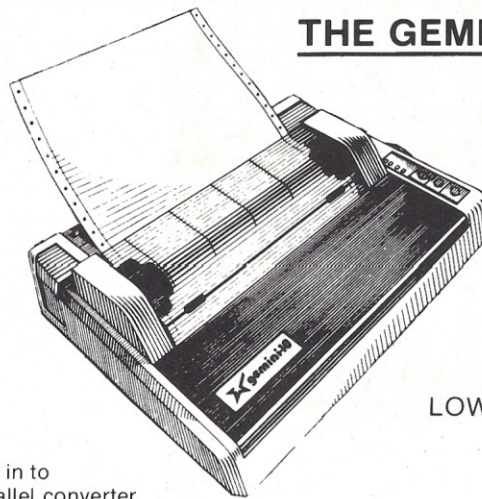
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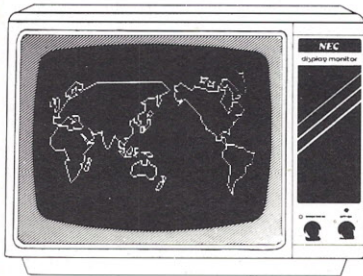


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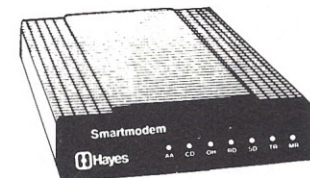
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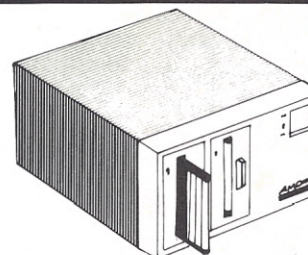
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wise, enter 2 and then enter BI as the abbreviation and BANK INTEREST as the long description.

Now that the two revenue accounts are established, we can enter the disbursement accounts. In answer to the ENTER ACCOUNT NUMBER prompt, enter 10 (remember, we decided that the first nine accounts were to be revenue accounts). Now enter RE as the abbreviation and RENT as the full account name. Next, choose 11 and enter NE as the abbreviation and NEWSLETTER as the full name.

When the ENTER ACCOUNT NUMBER prompt appears again, just press Enter to indicate that the initialization process is complete. The program will then offer you the option of obtaining a printout of your account codes (see Figure 1), after which it returns you to the main menu. (see Photo 1).

WINNIPEG MICRO - 80 USERS GROUP ACCOUNT CODES		
RECEIPTS		
1	MF	ANNUAL MEMBERSHIP FEE
2	BI	BANK INTEREST
3		
4		
5		
6		
7		
8		
9		
EXPENDITURES		
10	RE	RENT
11	NE	NEWSLETTER
12		
13		
14		
15		
16		
17		
18		
19		
20		

Figure 1. Account Codes

● **Add Data to File** — This routine is used to enter your cash receipts and disbursements transactions. For each transaction you are asked to enter a date, a description, an account code, and an amount.

The date should be entered in the format YYMMDD. March 15, 1983 would be entered as 830315. December 9, 1983 would be entered as 831209. Since I often find that I have to enter several transactions with the same date, CASHBOOK is written so that, if you enter s as the date, the transaction will be

♦ more

CASHBOOK VARIABLES USED

AC\$()	Full account code name
B1\$()	Date of a transaction
B2\$()	Description of a transaction
B3\$()	Account a transaction is charged to
B4\$()	Amount of a transaction
C	Maximum number of transactions that can be recorded
C1	Maximum number of account codes
C2	Maximum number of revenue accounts
CC	Number of transactions so far
F1\$	Format string for PRINTUSING statements
F3\$	Format string for PRINTUSING statements
F4\$	Format string for PRINTUSING statements
F5\$	Format string for PRINTUSING statements
F6\$	Format string for PRINTUSING statements
F7\$	Format string for PRINTUSING statements
FA\$	First day of period covered by Statement of Receipts and Disbursements
FB\$	Last day of period covered by Statement of Receipts and Disbursements
FC\$	Quotation marks — CHR\$(34)
FS\$	Data file name
FT\$	Temporary data file name
H	Length of print line a heading is to be centered on
H\$	Heading of a statement
HP\$	Heading of a statement
L	Counter in For...Next loops
L1	Counter in For...Next loops
LF	Flag in sort routine
M1\$	Menu choice
N\$	Name of organization
Q	Val (Q\$)
Q\$	Account number that the operator wants a printout of
R1\$	"Receipts"
R2\$	"Disbursements"
S\$	Description to be searched for
SA\$	Two-character abbreviation for an account code
T	Multi-purpose temporary variable
T\$	Multi-purpose temporary variable
T()	Total charges to each account code
T1	Length of underline when printing totals
T1\$	Temporary storage during sort
T2\$	Temporary storage during sort
T3\$	Temporary storage during sort
TE	Total expenditures
TR	Total receipts
TR\$	Used in calculating T1
X\$	Multi-purpose input string
Y	Counter for number of lines printed
Y1	Number of transactions to be printed per page
Y2	Counter for blank lines on transaction printout

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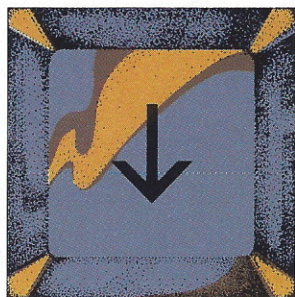
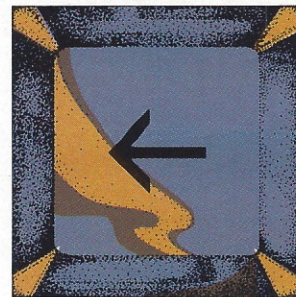
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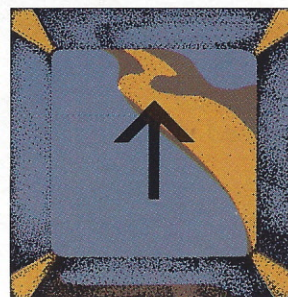
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given the same date as the previous transaction.

After entering the date, you are asked to enter a description of the transaction. If you enter s as the description, this transaction will be given the same description as the previous one.

CASHBOOK then prints a list of the available account codes. Choose an account and enter its number.

Next, you are asked to enter the amount of the transaction. If you chose an expenditure account in the previous step, the amount you enter will automatically be changed to a negative amount.

There may be some circumstances under which you want a positive amount shown in an expenditure account. For example, you may have received a partial refund of a previously-entered expenditure. If you want this refund shown as a reduction of expenditures, enter the amount as a negative number; CASHBOOK will change it to a positive number. Since expenditures are negative amounts, this positive amount in an expenditure account will be treated as a reduction of expenditures.

Likewise, if you want a transaction to be recorded as a reduction to a revenue account, enter the amount as a negative number.

When you've entered the amount, the transaction entry is complete and CASHBOOK shows you what the transaction looks like. You are then asked for the date of the next transaction and the process is repeated.

When you've entered all the transactions, just press Enter when asked for the date. You will then be returned to the menu.

● **Correct Data** — This routine is fairly straightforward. Start by entering the date of the transaction you wish to correct. CASHBOOK finds the first transaction with that date, prints the details of that transaction, and asks you if this is the one you want to correct. If it isn't, press Enter and CASHBOOK will find the next transaction with the specified date.

When it finds the transaction you want, answer Y to the THIS ONE (Y/N)? query. You will then be asked for the corrected date, description, account code and amount. If any of these four fields are already correct, just press Enter when asked for the correction.

When you've finished, CASHBOOK shows you what the corrected transaction looks like and returns you to the menu.

● **Display File — Video or Printout** — This routine gives you the option of obtaining either a list of all transactions

or a list of just those transactions charged to a specified account. Output may be directed to the screen or to a printer, depending on whether you chose "V" or "H" at the menu.

To obtain a list of all transactions, just press Enter in response to the ACCOUNT NUMBER ? (DEFAULT IS COMPLETE FILE) prompt. For a list of all transactions charged to a particular account, enter the number shown to the left of the desired account code.

Because of the limitations of the Color Computer's 32-character screen, only the first 12 characters of each transaction description are displayed on the screen. If you choose the printout option,

about 40 characters of description can be printed. If you want to see the complete description for a transaction without using the printer, use the Correct Data routine to look up and display the transaction.

If you choose the printout option, CASHBOOK will print a blank line after every fifth transaction. This is to make the data easier to read (see Figure 2).

● **Print Financial Statements** — This routine is designed to be used with a printer. All the operator has to do is enter the time period covered by the statement. The program will then print a Statement of Receipts and Disburse-

WINNIPEG MICRO - 80 USERS GROUP COMPLETE FILE			
830108	FRED SMITH	MF	20.00
830108	JOHN DOE	MF	20.00
830108	DON RIGG	MF	20.00
830108	VINCE RIGG	MF	10.00
830108	DON RICE	MF	20.00
830110	JOE'S PRINT SHOP	NE	65.36-
830122	MARY BROWN	MF	20.00
830122	JIM KUBAS	MF	20.00
830122	MEL SEDER	MF	20.00
830122	MIKE SEDER	MF	10.00
830201	HOME ST. CHURCH	RE	50.00-
830215	DON RIGG - PHOTOCOPIES	NE	10.74-
830228	BANK OF MONTREAL	BI	1.50
		TOTAL =	35.40
WINNIPEG MICRO - 80 USERS GROUP ANNUAL MEMBERSHIP FEES			
830108	FRED SMITH	MF	20.00
830108	JOHN DOE	MF	20.00
830108	DON RIGG	MF	20.00
830108	VINCE RIGG	MF	10.00
830108	DON RICE	MF	20.00
830122	MARY BROWN	MF	20.00
830122	JIM KUBAS	MF	20.00
830122	MEL SEDER	MF	20.00
830122	MIKE SEDER	MF	10.00
		TOTAL =	160.00
WINNIPEG MICRO - 80 USERS GROUP NEWSLETTER			
830110	JOE'S PRINT SHOP	NE	65.36-
830215	DON RIGG - PHOTOCOPIES	NE	10.74-
		TOTAL =	76.10-

Figure 2. Sample Printout — Complete File and Selected Accounts

WINNIPEG MICRO - 80 USERS GROUP STATEMENT OF RECEIPTS AND DISBURSEMENTS FOR THE PERIOD FROM JANUARY 1, 1983 TO FEBRUARY 28, 1983			
RECEIPTS			
ANNUAL MEMBERSHIP FEES			160.00
BANK INTEREST			1.50
TOTAL RECEIPTS			161.50
DISBURSEMENTS			
RENT		50.00	
NEWSLETTER		76.10	
TOTAL DISBURSEMENTS			126.10
EXCESS OF RECEIPTS OVER DISBURSEMENTS			35.40
			=====

Figure 3. Sample Printout — Financial Statements Table.

ments, as shown in the sample run (see Figure 3).

The dates you enter are used only for the heading. The statement will take into account every transaction in the file. The program will not test to ensure that a transaction's date is within the dates you specified.

● **Change Account Codes** — This routine lets you change the organization name, change the number of revenue accounts, and change, or add to, the list of account names.

If you already have some data on file, be careful when changing the number of revenue accounts. Make sure you don't change a presently-existing revenue account into an expenditure account, or vice-versa.

I also wouldn't recommend changing the abbreviation for an account if you have already entered transactions charged to that account.

If you have a printer, you can obtain a printout of your account codes.

● **Sort into Date Order** — This routine sorts your transactions by date, putting the earliest date first.

● **Save Data to Disk** — The only unusual thing in this routine is that you can

save a back-up copy of your data under a different file name on the same disk. CASHBOOK does this by temporarily changing the last character of your data file name to a B and then re-saving the data. For example, if your data file name is "CLUBCASH/DTA," your data will be saved once under that file name and then again under "CLUBCASH/DTB."

If, on a subsequent run, you find that "CLUBCASH/DTA" won't load for some reason, run the program again and specify "CLUBCASH/DTB" as the data file name. After the data has loaded and you're at the menu, press Break and Enter: FS\$ = "CLUBCASH/DTA" : GOTO 100. You've now recovered your data and can proceed.

● **Description Search** — This is a simple in-string search of each transaction description on file. Specify the string to be searched for and CASHBOOK will print the details of every transaction which contains that string within its description.

● **Test for Errors** — Since CASHBOOK lets you change your account code names even after you've entered some transactions, there is a danger that you may end up with transactions charged to accounts which no longer exist. These

transactions would show up on a listing of the complete file, but would be left out of the Statement of Receipts and Disbursements. Also, if the account code is no longer valid, you would not be able to obtain a list of just the transactions charged to that account.

The test for errors first checks to see that all transactions are charged to a valid account code. If it finds any errors they must be corrected.

You will also be told of any revenue transactions with negative amounts and any expenditure transactions with positive amounts. These are not necessarily errors, but they are unusual enough to be pointed out.

Closing Comments

Very important — remember to save your data before exiting from the program!

If the coding of the Save Data routine looks a little strange, that's because CASHBOOK was originally written for a Model 1. I found the same disk I/O coding worked on the Color Computer, so I decided to leave it alone.

Many thanks to Mel Seder for his help modifying this program to work on the Color Computer, and testing and enhancing the program. ■ ■ ■

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Program Listing. Cashbook

```

0 GOTO 26000 ' CASHBOOK/CC
2 CLS:PRINT@96,"INITIALIZING"
10 GOTO25010
60 PRINT"PRESS ANY KEY"
61 IFINKEY$=""THEN61 ELSERETURN
65 PRINT#-2,STRING$(H/2-LEN(H$)/
2,32)H$:RETURN
90 PRINT USINGF1$;B1$(L),B2$(L),
B3$(L),B4(L):RETURN
95 PRINT"DATE : "B1$(L):PRINT"DE
SCRIPTION : "B2$(L):PRINT"ACCOU
NT CODE : "B3$(L):PRINT"AMOUNT :
";:PRINTUSING"#####.##-";B4(L):R
ETURN
99 INPUT"PRESS <ENTER> FOR MENU"
;X$
100 T=0:Y=0:Y2=0:T$= INKEY$
105 CLS:PRINT
110 PRINT" < A >   ADD TO DATA O
N FILE      < C >   CORRECT ENTRI
ES":PRINT
120 PRINT" < V >   DISPLAY FILE
ON VIDEO    < H >   HARD COPY OF
FILE":PRINT
130 PRINT" < & >   SAVE DATA TO
DISK        < F >   FINANCIAL STA
TEMENTS":PRINT

```

```

140 PRINT" < S >   SORT INTO DAT
E ORDER     < I >   CHANGE ACCOUN
T CODES":PRINT
150 PRINT" < D >   DESCRIPTION S
EARCH       < T >   TEST FOR ERRO
RS"
200 M1$= INKEY$:IFM1$=""THEN200
210 CLS:ON INSTR("AVHC&FISDT",M1
$)GOTO1010,5010,5010,2010,4010,6
010,7010,8010,9010,10010
220 GOTO100
1000 REM add data to file
1010 FORL=CC+1TOC+1:CLS:IF(L=C+1
)THEN PRINT"SORRY - I CAN'T HOLD
ANY MORE":GOTO99
1020 PRINT"ENTER DATE (YYMMDD)"
1030 INPUT"(DEFAULT IS MENU)";B1
$(L)
1040 IFB1$(L)=""THEN100
1050 IFB1$(L)="S"THENB1$(L)=B1$(
L-1)
1060 IF LEN(B1$(L))<>6THENB1$(L)
="":GOTO1020
1070 INPUT"DESCRIPTION";B2$(L)
1080 IFB2$(L)="S"THENB2$(L)=B2$(
L-1)
1090 GOSUB15010:B3$(L)=SA$(L1)

```

more

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```

1100 INPUT"AMOUNT ";B4(L)
1110 IFL1>C2 THENB4(L)= -B4(L)
1120 PRINT:PRINT"ITEM IS RECORDE
D AS : "
1130 GOSUB95:PRINT
1140 CC=L:INPUT"PRESS ENTER TO C
ONTINUE";T$
1150 NEXTL
2000 REM correct data
2010 PRINT"ENTER DATE OF TRANSAC
TION":PRINT"TO BE CORRECTED (YYM
MDD)":INPUTT$
2020 FORL=1TOCC
2030 IFB1$(L)<>T$THEN2120
2040 PRINT:GOSUB95
2050 PRINT:INPUT"THIS ONE (Y/N)"
;X$:IFX$<>"Y"THEN2120
2060 PRINT:PRINT"JUST PRESS <ENT
ER> FOR THE ITEMSTHAT ARE O.K."

2070 PRINT:PRINT"CORRECTED DATE"
:INPUTT$:IFT$<>" "THENB1$(L)=T$
2080 PRINT:PRINT"CORRECTED DESCR
IPTION":INPUTT$:IFT$<>" "THENB2$(
L)=T$
2090 CLS:PRINT"ENTER CLASSIFICAT
ION NUMBER":GOSUB15010:IFL1>0AND
L1<C1+1THENB3$(L)=SA$(L1)
2100 PRINT:PRINT"CORRECTED AMOUN
T":PRINT" (ENTER EXPENSES AS":P
RINT" A NEGATIVE AMOUNT)":INPUT
T:IFT<>0THENB4(L)=T
2110 PRINT:PRINT"ENTRY NOW READS
":GOSUB95:PRINT:GOTO99
2120 NEXTL:GOTO99
3000 REM load data from disk
3010 PRINT"LOADING FILE: "FS$
3020 OPEN"I",1,FS$:INPUT#1,C1,C2
,CC,N$
3030 DIMSA$(C1),AC$(C1),T(C1)
3040 FORL=1TOCC:INPUT#1,B1$(L),B
2$(L),B3$(L),B4(L):NEXTL
3050 FORL=1TOC1:INPUT#1,SA$(L),A
C$(L):NEXTL:CLOSE:GOTO100
4000 REM save data to disk
4010 FT$=FS$
4020 PRINT" YOU ARE IN THE *SAVE
* ROUTINE. PREVIOUS DATA UNDER
FILENAME : "FT$" WILL BE LOST":
PRINT" AND REPLACED WITH THE DAT
A NOW IN MEMORY":PRINT
4030 INPUT" ENTER <S> TO CONTI
NUE";T$:IFT$<>"S"THEN100
4040 OPEN"O",1,FT$:PRINT"DATA FI
LE NAME IS":PRINTFT$

```

```

4050 PRINT#1,C1,C2;CC;FC$;N$;FC$
;:FORL=1TOCC
4060 PRINT#1,B1$(L);",";B2$(L);"
",";B3$(L);",";B4(L);:NEXTL
4070 FORL=1TOC1:PRINT#1,SA$(L);"
",";FC$;AC$(L);FC$;",";:NEXTL
4080 CLOSE:IF RIGHT$(FT$,1)<>"B"
THEN INPUT" ENTER <B> FOR A BACK
UP COPY";X$:IFX$="B"THENFT$= LEF
T$(FSS,LEN(FS$)-1)+"B":PRINT"BAC
KUP ";:GOTO4040
4090 GOTO100
5000 REM video/prINTER display
5010 IFM1$="H"THEN PRINT" PREPAR
E PRINTER":INPUT" HOW MANY TRANS
ACTIONS PER PAGE? (DEFAULT IS 50
)";Y1:PRINT#-2," ":PRINT#-2," ":
PRINT#-2," ":H$=N$:GOSUB65:IFY1=
0THENY1=50
5020 GOSUB15010
5030 PRINT" ACCOUNT NUMBER ?":PR
INT" (DEFAULT IS COMPLETE FILE)"
:INPUTQ$
5040 CLS:IFQ$=""THENHP$="COMPLET
E FILE":GOTO5080
5050 Q= VAL(Q$)
5060 IF Q<1ORQ>C1 THEN5020
5070 HP$=AC$(Q):Q$=SA$(Q)
5080 IFM1$="H"THENH$=HP$:GOSUB65
:PRINT#-2," "
5090 FORL=1TOCC:IFQ$=""THEN5110
5100 IFB3$(L)<>Q$THEN5170
5110 T=T+B4(L)
5120 Y=Y+1:IFM1$="V"AND Y=13 THE
NY=0:GOSUB60
5130 GOSUB90
5140 IFM1$<>"H"THEN5170
5150 IFY=Y1 THENY=0:INPUT"ADVANC
E PAPER AND PRESS ENTER";X$:PRIN
T#-2," ":PRINT#-2," ":PRINT#-2,"
":H$=HP$+" (CONT.)":GOSUB65:
PRINT#-2," ":Y2=0

5160 PRINT#-2,USINGF4$;B1$(L),B2
$(L),B3$(L),B4(L):Y2=Y2+1
5165 IFY2=5THENPRINT#-2," ":Y2=0

5170 NEXTL
5180 PRINT:PRINTUSINGF7$;T:IFM1$
="H"THEN PRINT#-2," ":PRINT#-2,T
AB(30)" ";:PRINT#-2,USINGF7$;T
5190 GOTO99
6000 REM print finan. statement
6010 PRINT" > PREPARE PRINTER <
":PRINT

```

♦ more


```

6020 TR=0:TE=0:FORL1=1TOC1:T(L1)
=0:NEXT
6030 PRINT" FINANCIAL STATEMENTS
FOR THE PERIOD FROM ...";
6040 LINEINPUTFA$:LINEINPUT" TO
...";FB$

```

```

6050 PRINT#-2," ":PRINT#-2," ":P
RINT#-2," "
6060 H$=N$:GOSUB6540:GOSUB6500:G
OSUB6510:PRINT#-2," ":PRINT#-2,"
":GOSUB6520:PRINT#-2," "
6070 PRINT,"CALCULATING":FORL=1T
OCC:FORL1=1TOC1
6080 IFB3$(L)=SA$(L1)THENT(L1)=T
(L1)+B4(L)ELSE NEXTL1
6090 NEXTL

```

```

6100 FORL1=1TOC2:TR=TR+T(L1)
6110 IFT(L1)<>0THENPRINT#-2,USIN
GF3$;AC$(L1),T(L1):PRINT#-2," "
6120 NEXTL1
6130 TR$=STR$(INT(TR)):T1=LEN(
TR$)+2:PRINT#-2," ":PRINT#-2," "
:PRINT#-2,STRING$(72-T1," ")STRI
NG$(T1,"-"):T$=STRING$(18,32)+"
TOTAL "+R1$:PRINT#-2,USINGF3$;T$
,TR

```

```

6140 PRINT#-2," ":PRINT#-2," ":P
RINT#-2," ":PRINT#-2," "
6150 GOSUB6530:PRINT#-2," ":PRIN
T,"CALCULATING"

```

```

6160 FORL1=C2+1TOC1:TE=TE+T(L1)
6170 IFT(L1)<>0THENPRINT#-2,USIN
GF5$;AC$(L1),-T(L1):PRINT#-2," "

```

```

6180 NEXTL1
6190 PRINT#-2," ":PRINT#-2," ":T
$=STRING$(16,32)+"TOTAL "+R2$:P
RINT#-2,USINGF3$;T$,-TE
6200 PRINT#-2," ":PRINT#-2," ":P
RINT#-2,STRING$(72-T1," ")STRING
$(T1,"-")
6210 T$="EXCESS OF "+R1$+" OVER
"+R2$

```

```

6220 PRINT#-2,USINGF3$;T$,TR+TE
6230 PRINT#-2,STRING$(72-T1," ")
STRING$(T1,"=")
6240 GOTO99
6500 H$="STATEMENT OF "+R1$+" AN
D "+R2$:GOTO6540
6510 H$="FOR THE PERIOD FROM "+F
A$+" TO "+FB$:GOTO6540

```

```

6520 H$=R1$:GOTO6540
6530 H$=R2$
6540 GOSUB65:RETURN
7000 REM init/change acct codes
7010 PRINT" ORGANIZATION NAME IS
":PRINT" "N$:PRINT" ENTER NEW
NAME":PRINT" IF YOU WANT TO CHAN
GE THIS ...":LINEINPUTT$:IFT$<>"
"THENN$=T$
7020 PRINT:PRINT:PRINT" YOU PRES
ENTLY HAVE"C2:PRINT" REVENUE ACC
OUNTS":INPUT" ENTER NEW NUMBER T
O CHANGE THIS";T:IFT<>0THENC2=T

```

```

7030 CLS:PRINT"RECEIPTS":Y=0:FOR
L1=1TOC1
7040 PRINTUSINGF6$;L1,SA$(L1),AC
$(L1)
7050 IFL1=C2THEN PRINT" EXPENDIT
URES":Y=Y+1
7060 Y=Y+1:IFY=13THENY=0:INPUT"
PRESS ENTER TO CONTINUE";X$
7070 NEXT
7080 PRINT" ENTER ACCOUNT NUMBER
":INPUTL1:IFL1=0THEN7500
7085 IF L1>C1 THEN7030

```

```

7090 PRINT" THIS NOW READS :"
7100 PRINT USINGF6$;L1,SA$(L1),A
C$(L1)
7110 PRINT" ENTER NEW 2-CHARACTE
R CODE":INPUTSA$(L1)
7120 PRINT" NEW LONG DESCRIPTION
...":LINEINPUTAC$(L1)
7130 GOTO7030
7500 PRINT" ENTER <Y> IF YOU WAN
T A HARD COPY OF YOUR ACCOUNT
CODES"
7510 INPUTX$:IFX$<>"Y"THEN100
7520 INPUT" PREPARE PRINTER & PR
ESS ENTER ";X$
7530 PRINT#-2," ":PRINT#-2," ":P
RINT#-2," ":H$=N$:GOSUB65

```

```

7540 H$="ACCOUNT CODES":GOSUB65:
PRINT#-2," "
7550 PRINT#-2," RECEIPTS":FO
RL=1TOC1:PRINT#-2," ";:PRINT
#-2,USINGF6$;L,SA$(L),AC$(L)
7560 Y=Y+1:IFY=3THENY=0:PRINT#-2
," "
7570 IFL=C2 THENPRINT#-2," ":PRI
NT#-2," EXPENDITURES":Y=0
7580 NEXTL:GOTO100

```

◆ more


```

8000 REM sort by date
8010 LF=0:FORL=1TOCC-1
8020 IFB1$(L)>B1$(L+1)THENT1$=B1$(L):T2$=B2$(L):T3$=B3$(L):T=B4(L):B1$(L)=B1$(L+1):B2$(L)=B2$(L+1):B3$(L)=B3$(L+1):B4(L)=B4(L+1):B1$(L+1)=T1$:B2$(L+1)=T2$:B3$(L+1)=T3$:B4(L+1)=T:LF=1
8030 NEXTL:IFLF=1THEN8010
8040 GOTO100
9000 REM search for description
9010 PRINT" ENTER FULL/PARTIAL DESCRIPTION":INPUTS$
9020 FORL=1TOCC
9030 IF INSTR(B2$(L),S$)>0 THENGOSUB90:T=T+B4(L):Y=Y+1:IFY=13THENY=0:INPUTT$
9040 NEXT:PRINTUSINGF7$;T:GOTO99

10000 REM test for errors
10010 PRINT" TESTING FOR ERRORS":FORL=1TO CC
10020 IFB3$(L)=""THEN10060
10030 FORL1=1TO C1
10040 IFB3$(L)=SA$(L1)THEN10080
10050 NEXTL1
10060 PRINT"ACCT. CODE DOES NOT MATCH ANY OFYOUR CHOSEN CODES."
10070 GOSUB10500:IFX$="!"THEN100ELSE10100
10080 IFL1>C2 AND B4(L)>0 THENPRINT"ITEM"L" IS AN EXPENDITURE":PRINT"BUT THE AMOUNT IS POSITIVE":GOSUB10500:IFX$="!"THEN100
10090 IFL1<=C2 AND B4(L)<0 THENPRINT"ITEM"L" IS A REVENUE ITEM":PRINT"BUT THE AMOUNT IS NEGATIVE":GOSUB10500:IFX$="!"THEN100
10100 NEXTL:GOTO99
10500 GOSUB90:PRINT" PRESS <ENTER> TO CONTINUE":PRINT" "FC$!"FC$" FOR MENU"
10510 INPUTX$:RETURN
15000 REM get acct code no.
15010 Y=0:PRINT" RECEIPTS"
15020 FORL1=1TO C1
15030 IFSA$(L1)=""THEN15050
15040 PRINTUSINGF6$;L1,"",AC$(L1):Y=Y+1:IFY>11THENY=0:INPUT" PRESS <ENTER>";X$:IFVAL(X$)>0THENL1=VAL(X$):GOTO15080
15050 IFL1=C2 THEN PRINT" EXPENDITURES":Y=Y+1
15060 NEXTL1:IFM1$="V"ORM1$="H"THEN15130
15070 INPUT" NUMBER";L1

```

```

15080 IF L1>C1 THEN15010
15090 IFL1<1THEN15120
15100 IFSA$(L1)=""THEN15120
15110 GOTO15130
15120 IFM1$="A"THEN PRINT,"INVALID ACCOUNT":GOTO15010
15130 Y=0:RETURN
25000 REM initialization
25010 CLEAR8000:C=500
25020 DIML,Y,B1$(C),B2$(C),B3$(C),B4(C)
25040 F1$="%" + STRING$(4,32) + "%" + STRING$(1,32) + "%" + STRING$(10,32) + "%" + STRING$(1,32) + "%#####.##-"
25050 F3$=STRING$(8,32) + "%" + STRING$(44,32) + "%" + STRING$(9,32) + "%#####.##-"
25060 F4$=STRING$(8,32) + "%" + STRING$(4,32) + "%" + STRING$(5,32) + "%" + STRING$(37,32) + "%" + STRING$(3,32) + "%" + STRING$(1,32) + "%" + STRING$(3,32) + "%#####.##-"
25070 F5$=STRING$(8,32) + "%" + STRING$(34,32) + "%" + STRING$(3,32) + "%#####.##"
25080 F6$="##" + STRING$(2,32) + "%" + STRING$(1,32) + "%" + STRING$(2,32) + "%" + STRING$(19,32) + "%"
25090 F7$=STRING$(12,32) + "TOTAL = #####.##-"
25100 FC$=CHR$(34)
25110 H=80:R1$="RECEIPTS":R2$="DISBURSEMENTS"
25120 DIR
25130 PRINT:PRINT:PRINT" ENTER DATA FILE NAME":INPUTFSS$:IFFS$=""THEN25120
25140 PRINT:PRINT" IS THIS YOUR INITIAL RUN (Y/N)":INPUTX$:CLS:IFX$<>"Y"THEN3010
25150 PRINT" THE FIRST STEP IS TO ESTABLISH YOUR ACCOUNT CODES.":PRINT:PRINT" HOW MANY ACCOUNT CODES":PRINT" (TOTAL OF REVENUE AND":PRINT" EXPENDITURE CODES) DO YOU WANT?":PRINT"*-NOTE-: YOU WILL NOT BE ABLE TO CHANGE THIS NUMBER LATER"
25160 INPUTC1:DIMSA$(C1),AC$(C1),T(C1)
25170 PRINT" ENTER THE NAME OF":PRINT" THE ORGANIZATION":LINEINP:UTN$:GOTO7020
26000 PCLEAR 1:GOTO1

```


The OS-9 experts have developed something new.

C Compiler Version 2 for color computer OS-9 DOS for color computer Relocatable Assembler for Flex and CoCo DOS

C Compiler

Dugger's Growing Systems C is the original C Compiler for the 6809 and is the proven leader in the field. It is a growing subset of the C programming language. It runs in 20K, has assembly language output, position independent code, an extensive library in assembly language source, and code optimizer.

The Color Computer and Flex (which will run on the Color Computer) are now both available with full floating point package (float, long, for, goto, etc.) in addition to the basic C commands. CoCo Dos also contains features which use the BASIC ROM functions (cls, polcat, partial floating point, etc.).

Dugger's Growing Systems has the cost effective C for OS-9. It contains all the necessary C commands (while, if, if else, int., char, etc.) which may be linked, loaded, and used in a multi-user, multi-tasking environment.

Relocatable Assembler

The relocatable assembler package includes assembler, linker, and manager. May be used with the Color Computer or Flex.

Symbols up to 32 characters ☐ Many special characters allowed in symbols (\$, %, etc.) ☐ Multiple files assembled without exiting the assembler ☐ Direct output to printer at any time ☐ Generates either absolute or relocatable modules which are linked together with RLINK to generate executables ☐ Supports two types of global variables (VAR and COMN) Fortran type common ☐ Compatible with source for most assemblers ☐ Macros with parameters ☐ Conditional assembly.

Linker

Use text-like files which are generated by RASMB or any other source ☐ Allows inclusion of multiple source files, each of which can have any number of program modules ☐ Provide for library files, whose modules are included only as required ☐ Specify at link-time execution address and global storage area for easy generation of ROM-able code ☐ Will link together both absolute and relocatable modules ☐ Extensive linkage information output on request.

Manager

Provide a tool to build a "library" of relocatables ☐ Edit feature to list, insert, and delete modules.



Check and Compare Prices

CoCo C Compiler Version 2.3 (requires disk assembler and text editor)	49.95
Relocatable Assembler (package: assembler, linker, and manager) RASMB CoCo Version 1.7	49.95
Flex C Compiler Version 2.3	75.00
Relocatable Assembler (package: assembler, linker, and manager) RASMB Flex Version 1.7	75.00
OS-9 C Compiler Version 1.2	59.95
C Programming Language, Kernighan and Ritchie	19.95
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More Summer Project Winners



Spazmorg is the grand prize winner in The Basic category of The Summer Programming Project. It's a graphic real-time game and requires logic. It requires 16K Extended Basic, and won't operate with the disk controller plugged into the computer.

The game has three versions, and uses the right joystick in play. You play against the clock and against the giant spider and the Spazmorg that dwell in the castle in which you find yourself. You are trying to trap the baby Spazmorg — the joystick fire button lets you open doors as you pass from room to room in pursuit of the baby. Complete instructions and demonstrations are presented before the game, and should be read and considered before playing.

Enter the program, save it to cassette, and run the game. Menu prompts guide the user through the directions and into play.

Good luck, and have fun!

Program Instructions. Spazmorg

```
0 'SPAZMORG INSTRUCTION PROGRAM
3 CLS4:PLAY"V5":A$=CHR$(191)+CHR
$(175)+CHR$(191)+CHR$(175)+CHR$(
191)+CHR$(175):B$=CHR$(191)+CHR$
(175)+CHR$(175)+CHR$(175):C$=CHR
$(191)+CHR$(175)
```

```
4 FORX=161TO185
5 PRINT@X,C$;:PRINT@X+4,C$;:PRIN
T@X+32,A$;:PRINT@X+64,CHR$(143)+
CHR$(191)+C$;:PRINT@X+97,B$;:PRI
NT@X+128,A$;
6 PLAY"V+L9001ABC":NEXTX
8 PRINT@228,"***** SPAZMORG ****
*";
9 PLAY"L55V2001ABCDEFGFGFEDCBAO2AB
CDEFGFEDCBAO3ABCDEFGFGFEDCBAO4ABCD
EFGFEDCBAV25ABCDGDDGDDGO3DGDGDGO2
DGDGDGO1DGDGDGEDAEDAEDA02EDAEDA0
3EDAEDA04EDAEDAV22EDAEDAV20EDAED
AV18EDAEDAEDAV16EDAEDAEDAV15EDAE
DAEDAV12EDAEDAEDAV10EDAEDAV8EDAE
DAV6EDAEDAV4EDAEDAV3EDAA
10 PRINT@234,"spazmorg *****";
```

```
11 PLAY"V30"
12 PLAY"V-L55CBAO1"
13 C=C+1:IFC<25 THEN 12
15 FORX=1TO100:NEXTX
16 CLS:PRINT@420,"^^^ PICK ONE N
UMBER ^^^"
17 FORX=1TO30:PRINT@X,CHR$(140):
NEXTX
18 PRINT@42,"** MENU **"
19 PRINT@104,"1. GENERAL"
20 PRINT@136,"2. ROOMS"
21 PRINT@168,"3. YOU"
22 PRINT@200,"4. BABY SPAZMORG"
23 PRINT@232,"5. MOTHER SPAZMORG
"
24 PRINT@264,"6. SPIDER"
25 PRINT@296,"7. WINDS"
26 PRINT@328,"8. NO JOYSTICKS?"
27 PRINT@360,"9. VERSIONS"
28 PRINT@392,"C. CLOAD"
29 FORX=449TO478:PRINT@X,CHR$(13:
1):NEXTX
30 Q$=INKEY$
31 IF (Q$<"1"ORQ$>"9")ANDQ$<>"C"
```

more



PRICKLY-PEAR SOFTWARE

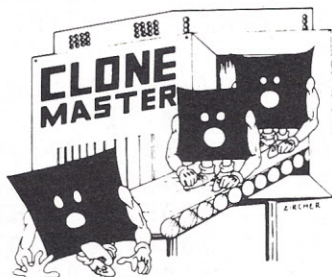
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PROGRAMS REQUIRE 16K EXTENDED BASIC FOR TAPE, AND 32K DISK UNLESS OTHERWISE NOTED.

FOUR GREAT NEW PROGRAMS

Varalyzer

A breakthrough in programming utilities from the author of Colorkit! You may need a little background for this program. The first time you mention a variable in a BASIC program, the computer assigns a space in the variable table in memory. It starts at the bottom of the table and works up to the top, and the next time that variable is called in your program the computer goes to the variable table to look it up. The search starts at the bottom of the table and continues until the variable is located. This takes time, and the farther up the table the variable is located, the longer it takes. There is a BIG SPEED ADVANTAGE in having the most frequently called variable located first in the table, with the next most frequently called variable second, etc. This program simply examines your BASIC program while it is running and then actually modifies it to speed it up! Speed increase will be from 5% to 75%, depending upon the program, and we include a list of other tips to speed up execution even more. This program will also print a list of the variables used in the program and tell you how many times each is called. VARALYZER is 100% machine language and REQUIRES 64K to run. Works fine on either disk or tape systems. **\$24.95**



Clone Master

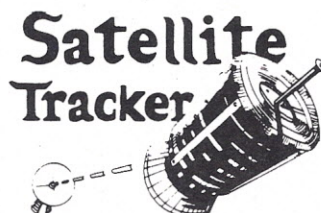
This is the ultimate disk backup utility, and who else but Prickly-Pear, originators of Omni-Clone, could bring it to you. If you are tired of waiting for your BACKUP command to finish, you'll like the speed of CLONE MASTER. This program checks the computer memory size, and if you have a 64K machine it will do a backup on a full disk in about 7 minutes — including formatting the destination disk — with only THREE swaps, not the seven you are used to, and if you are running multiple drives, CLONE MASTER will handle up to 4 double-sided drives. In addition, although we can't guarantee that CLONE MASTER will back up any disk, it can handle backups of any non-standard (protected) disk we have seen — not only on the Color Computer, but on Model III and IV, IBM PC, Kaypro, Osborne, and Atari. It handles up to 256 tracks, single and double density — even on the same track, CRC errors, and lots more. It even checks the speed of your drives for you! If you are using a disk drive, you know how disks will crash, so don't leave your valuable software unprotected any longer. Back it up or lose it! CLONE MASTER will adjust to any memory size and works with any version of the ROM's — including the JVC controller. **\$39.95**

Your personal check is welcome - no delay. Include \$1.50 shipping for each program ordered. (Shipping free on \$50.00 or larger orders). AZ residents add 7% sales tax. Orders shipped within two days.

Erland



The most complex simulation we have ever seen, and you VIKING! fans will want to take note. This game has you running a small holding in old Ireland. You must manage your land, sheep, army, markets, fishing fleets, taxes, and many other factors while you try to rise in rank to become King or Queen. You may attack — or be attacked — by the other players, and you will have to face the fact that there isn't enough land to go around, and you may have to take some away from someone else! This 32K game is considerably more complex and difficult than our super popular VIKING! Because of this, we have added a save-the-game feature. ERLAND is for 2 to 5 game lovers, and will warm the heart of anyone who liked VIKING!, Monopoly, or other classic strategy games. This game is a hybrid of Extended Basic and Machine language. The disk and tape versions are not interchangeable. **Tape — \$24.95; Disk — \$29.95**



Satellite Tracker

If you are interested in reception of transmissions from the television satellites, you will need this program. It does all calculations associated with planning and setting up a satellite dish antenna. It figures antenna gain, signal to noise, aiming point for any geosynchronous satellite, effect of various quality amplifiers, and a lot more. The program will tell you whether a dish is practical in your location, how big it needs to be, and what kind of picture quality and signal strength you will achieve. If you are thinking of investing in a system, don't make a move until the results are in. Requires 32K extended BASIC and some (limited) knowledge of satellite terms and language. **\$79.95**

Dealer and author inquiries are always welcome. Canadian dealers should contact Kelly Software Distributors, Ltd., P. O. Box 11932, Edmonton, Alberta T5J-3L1 (403) 421-8003

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```

THEN 30
33 PLAY"V5":FORX=1TO25:PLAY"V+L2
5501A":PRINT:NEXTX
34 IFQ$="C"THEN145
35 Q=VAL(Q$):ON Q GOTO36,73,94,1
02,111,120,126,135,138
36 CLS8:PRINT@134," WELCOME TO S
PAZMORG ";
37 PLAY"V25L1605ABCDGGGGGGGFEDBCB
CBDGEEEEFFEDCACACDEFDEEEEDFDGFDA
BCDDDDCBABCCCBABCACBCACBACBACBAC
BBBB
38 PRINT@232," ENJOY YOUR STAY "
;:FORX=1TO800:NEXTX
40 CLS:PRINT"    WITHIN THE DEPTH
S OF CRAGMORETOWER THERE DWELLS
THE SPAZMORG.HE'S A MAGICAL CREA
TURE FROM THEUNDERWORLD. ONCE EV
ERY THOUSAND"
44 PRINT"YEARS IT HAS OFFSPRING.
"," A YOUNG SPAZMORG IS A HARMLE
SS LITTLE CREATURE WHOSE ONLY TY
PE OF DEFENSE IS TO RUN AWAY. TH
E MATURE SPAZMORG IS A VICIOUS
CARNIVORE WHO FEEDS ON HUMANS."
50 PRINT"YOU MUST CAPTURE THE YO
UNG","SPAZMORG WHILE IT'S MOTHER
IS AWAY. IF YOU TAKE TOO LONG
, SHE MAY RETURN.":GOSUB70
56 CLS0:PRINT,"    ALSO, IF YOU
ARE NOT CAREFUL YOU MAY BE DEVOU
RED BY THE","GIANT SPIDER THAT D
WELLS IN THE GREEN ROOM OF THE T
OWER.," BEWARE!!!!!!!!":PRINT
61 GOSUB70
62 CLS:PRINT,"    THE TOWER ROOM
S ARE DESIGNED SO THAT EACH TIME
YOU PASS","THROUGH A DOORWAY, T
HE DOOR","LOCKS BEHIND YOU. TO R
EOPEN all"
63 PRINT"THE DOORS IN THE TOWER
YOU MAY PRESS THE JOYSTICK BUTT
ON OR","THE SPACE BAR ON THE KEY
BOARD. YOUR STRATEGY SHOULD BE
TO TRAP THE BABY SPAZMORG IN ONE
OF THE ROOMS WITH ALL THE DOORS
LOCKED BEHIND YOU.":GOSUB70
65 CLS:PRINT@160,"    REMEMBER, T
HE LOWER YOUR","    TIME, THE BET
TER!!!!!"
66 SCREEN0,1:FORX=1TO1000:NEXTX
67 PLAY"V30L25501GFEDCBAV25GFEDC
BAV20GFEDCBAV15GFEDCBAV10GFEDCBA
V5GFEDCBAV3GFEDCBAV2GFEDCBA"
68 GOTO16
69 CLS:A$=CHR$(191):PRINT@109,A$
:PRINT@113,A$:PRINT@141,A$:PRINT

```

```

@143,A$:PRINT@145,A$
70 PRINT@449,"** PRESS enter TO
CONTINUE **";:SCREEN0,1
72 Q$=INKEY$:IFQ$=CHR$(13)THEN R
ETURN ELSE72
73 CLS7:PRINT@169,"*** ROOMS ***
";:PLAY"T100V1503AEDAEDAEDAED"
74 FORX=1TO1000:NEXTX
75 CLS7:PRINT@160,"THE ROOMS ARE
ARANGED LIKE THIS.";
76 FORX=1TO1000:NEXTX
77 PMODE4,1:PCLS:LINE(50,30)-(20
0,160),PSET,B:LINE(100,30)-(100,
45),PSET:LINE(150,30)-(150,45),P
SET:LINE(100,160)-(100,145),PSET
:LINE(150,160)-(150,145),PSET
78 LINE(50,73)-(65,73),PSET:LINE
(50,118)-(65,118),PSET:LINE(200,
73)-(185,73),PSET:LINE(200,118)-
(185,118),PSET:LINE(85,73)-(115,
73),PSET:LINE(135,73)-(165,73),P
SET:LINE(85,118)-(115,118),PSET:
LINE(135,118)-(165,118),PSET
79 LINE(100,58)-(100,88),PSET:LI
NE(150,58)-(150,88),PSET:LINE(10
0,103)-(100,133),PSET:LINE(150,1
03)-(150,133),PSET:SCREEN1,1
81 FORX=1TO250:PLAY"V201L255AB":
NEXTX
82 CLS7:PRINT@163," YOU SEE ONLY
ONE ROOM ";
83 FORX=1TO1000:NEXTX
84 PMODE4,1:PCLS0:COLOR5:LINE(47
,150)-(208,30),PSET,B:COLOR0:LIN
E(115,30)-(145,30),PSET:LINE(115
,150)-(145,150),PSET:LINE(47,75)
-(47,105),PSET:LINE(208,75)-(208
,105),PSET:SCREEN1,1
86 FORX=1TO250:PLAY"DE":NEXTX
87 PRINT@160,"PRESS THE SPACE BA
R OR THE","JOYSTICK BUTTON TO RE
OPEN ALL THE DOORS.":PRINT"
    TRY IT."
88 PLAY"V0":G=0
89 FORX=1TO500:Q$=INKEY$:P=PEEK(
65280):IFP=126 ORP=254THEN G=1
90 IF Q$=CHR$(32)THEN G=1
91 IFG=1 THENPLAY"O1L20T20V+ABCD
EFG":W=W+1:IFW>10 THEN93 ELSE91
92 NEXTX:GOTO16
94 CLS3:PRINT@170,"*** YOU ***";
:PLAY"V30L1602AP32AP32AP32L803E
95 FORX=1TO1500:NEXTX:CLS
96 PRINT@67,"YOU'RE A FAMED TRAV
ELER","SENT OUT TO CAPTURE A SPE
CIMEN OF THE SPAZMORG. YOU'VE A
LREADY FOUND YOUR WAY INTO THE D

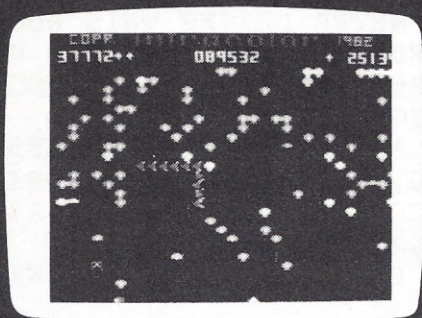
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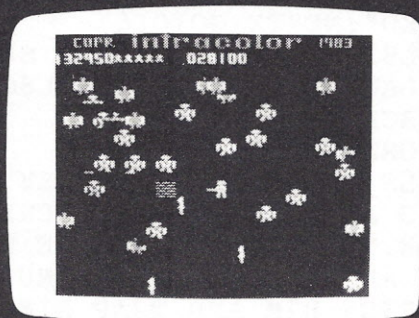


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This truly outstanding engineer designed, 100% machine language game with multi-colored high resolution characters and fast action will challenge the most avid arcade buff. Can be played by 1 or 2 players controlled with joy sticks or key board. Joy stick control is fast, smooth and accurate. As COLORPEDE slithers through the toad stools, you attempt to destroy the COLORPEDE, knock out the menacing Bouncing Bug and eliminate toad stools while accumulating higher and higher scores. Demonstration mode with top 5 scores. Pause feature. For 16K Color Computer and TDP-100.

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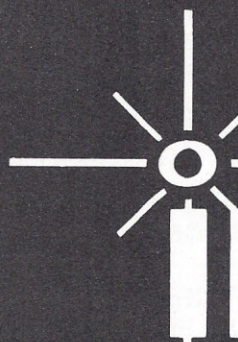
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```

EPHES OF THE TOWER WHERE IT DWELLS. NOW YOU MUST TRAP AND CA
TCH IT.";
97 PRINT"YOU START IN THE CENTER
OF NINE ROOMS. THE BABY SPAZMOR
G IS IN ONE OF THE OTHER ROOMS.
":GOSUB70
99 CLS:A$=CHR$(175)+CHR$(175)+CH
R$(175):PRINT@142,A$:FORX=171TO1
77STEP3:PRINT@X,A$:NEXTX:PRINT@2
06,A$:PRINT@236,A$:PRINT@240,A$
100 PRINT@294,"YOU LOOK LIKE THI
S"
101 FORX=1TO50:PLAY"V2L255T255O5
AGBFCED":NEXTX:GOTO16
102 CLS2:PRINT@169,"BABY SPAZMOR
G";:PLAY"V20L8T8O4ACEL6GL8GECABD
FFDBABCBAL4A"
103 FORX=1TO500:NEXTX
104 CLS:PRINT@35,"THE BABY SPAZM
ORG IS A FAIRLY HARMLESS CREATURE
. UPON YOUR","APPROACH HE WILL R
UN TO ANOTHER ROOM. YOU MUST TRY
TO TRICK HIM AND TRAP HIM IN A
ROOM WITH ALL THE DOORS CLOSED B
EHIND YOU."
105 PRINT" WARNING: HE WILL SOM
ETIMES","SNEAK THROUGH A DOOR JU
ST AS","YOU ENTER A ROOM. BE REA
DY TO GRAB HIM!":GOSUB70
107 CLS:A$=CHR$(191)+CHR$(191):P
RINT@109,A$:PRINT@111,A$:PRINT@1
13,A$:PRINT@143,A$:PRINT@173,A$:
PRINT@175,A$:PRINT@177,A$:PRINT@
205,CHR$(191):PRINT@207,A$:PRINT
@210,CHR$(191)
108 PRINT@263,"THE BABY SPAZMORG
":V=0
110 PLAY"V10O2L10T8GFEDCBA":V=V+
1:IFV<10 THEN110 ELSE16
111 CLS4:PRINT@166,"THE MOTHER S
PAZMORG";:PLAY"V30T6L6O1ABCDGFED
ABCDGFED"
112 FORX=1TO500:NEXTX
113 CLS:PRINT@34,"THE MOTHER SPA
ZMORG IS YOUR","MOST DANGEROUS E
NEMY! SHE IS","FASTER AND MORE P
OWERFUL THAN THE SPIDER. IN VE
RSION '1' SHE WILL START TO CHA
SE YOU AFTER A FEW MINUTES. IN
VERSIONS '2'"
114 PRINT"AND '3' SHE IS OUT FRO
M THE","START.":GOSUB70
116 CLS3:A$=CHR$(191):PRINT@109,
A$;:PRINT@113,A$;:PRINT@141,A$;:
PRINT@143,A$;:PRINT@145,A$;

```

```

117 PRINT@175,A$;:PRINT@206,A$+A
$+A$;:PRINT@237,A$;:PRINT@239,A$
;:PRINT@241,A$;
118 PRINT@294,"THE MOTHER SPAZMO
RG";
119 FORX=1TO20:PLAY"O1V10L20T20A
BCDCBA":NEXTX:GOTO16
120 CLS0:PRINT@168,"** THE SPIDE
R **";
121 FORX=1TO20:PLAY"O1V30T30L30A
CEGECA":NEXTX
122 CLS:PRINT@33,"THE SPIDER DWE
LLS IN THE GREEN ROOM OF THE TOW
ER. UNLIKE THE MOTHER SPAZMORG
HE NEVER LEAVES THIS ROOM. BE C
AREFUL WHEN YOU CHANGE ROOMS, O
R WHEN THE WINDS HIT. YOU MAY RU
N RIGHT INTO HIM!"
123 A$=CHR$(255)+CHR$(255):PRINT
@300,A$;:PRINT@305,A$:PRINT@334,
A$+CHR$(255):PRINT@364,A$:PRINT@
369,A$:GOSUB70:GOTO16
126 CLS5:PRINT@171,"** WINDS **"
;
127 PLAY"V24":F=0
128 PLAY"O1L255T200V-AEGBDCF":F=
F+1:IFF<23THEN128
129 CLS:PRINT@33,"THE MAGICAL WI
NDS OF THE TOWER CAN BE BOTH A P
ROBLEM OR A","LIFESAVER. THEY WI
LL BLOW","OCCASIONALLY AND SEND
YOU INTO A RANDOM ROOM. SOMETIM
ES THE","BABY SPAZMORG WILL BE T
HERE","AND SOMETIMES THE SPIDER
WILL BE THERE.":GOSUB70
132 PLAY"V24":F=0
133 PLAY"O1L255T200V-AEGBDCF":F=
F+1:IFF<23 THEN133 ELSE16
135 CLS6:PRINT@170,"NO JOYSTICKS
?";:FORX=1TO1000:NEXTX
136 CLS:PRINT@34,"IF YOU DON'T H
AVE JOYSTICKS, DON'T WORRY. THE
KEYBOARD CAN BE USED. "," THE A
RROWS ARE FOR DIRECTION, AND THE
SPACE BAR IS USED TO","OPEN ALL
THE DOORS IN THE TOWER."
137 GOSUB70:GOTO16
138 CLS8:PRINT@169,"** VERSIONS
**";:PLAY"O2L10T10V25ABCDEFGFED
FGFEDCBABCD CBABCD EFGFED EFGFED CBA
BCDCBAAABABA"
139 CLS:PRINT@34,"THERE ARE THRE
E VERSIONS YOU CAN TRY. YOU SHO
ULD START WITH THE FIRST, AND W
HEN YOU'VE","MASTERED IT TRY THE
OTHER TWO. THE SECOND AND THIR

```

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```

D VERSIONS HAVE DOORS THAT AUT
OMATICALLY OPEN AND CLOSE, MAK
ING THINGS"
140 PRINT"DIFFICULT. THE THIRD V
ERSION","HAS A MEANER, FASTER MO
THER.", "RESERVE THAT ONE FOR LAS
T.":GOSUB70
142 CLS:PRINT@34,"IF YOU WOULD L
IKE TO SWITCH","FROM JOYSTICKS T
O THE KEYBOARD (OR VICE VERSA)
THEN PRESS THE 'J' KEY DURING T
HE 'PLAY AGAIN?' SECTION."
144 GOSUB70:GOTO16
145 CLS3:PRINT@161,"ARE YOU REAL
LY READY TO CLOAD";:PRINT@200,"T
HE GAME? (Y/N)?"
146 Q$=INKEY$:IF Q$="N" THEN16 E
LSEIFQ$="Y" THEN148 ELSE146
148 CLS4:PRINT@165,"SET THE CASS
ETTE PLAYER";:PRINT@234," PRESS
enter ";
149 Q$=INKEY$:IFQ$<>CHR$(13)THEN
149 ELSECLOAD"SPAZMORG" ■ ■ ■

```

Program Listing. Spazmorg by A.E. Bogdan

```

0 CLS6:PRINT@168,"JOYSTICKS (Y,N
)?":;SCREEN0,1
1 E$=INKEY$:IFE$="Y"THENQ=1ELSEI
FE$="N"THENQ=0ELSE1
2 IFS>0THENCLS3:GOTO95ELSE SOUND1
78,1:CLS6:PRINT@170,"GAME (1,2,3
)?":;SCREEN0,1
3 E$=INKEY$:IFE$="1"THENELSEIFE$
="2"THENG=1ELSEIFE$="3"THENG=1
:I=1ELSE3
4 PMODE4:PCLS:SCREEN1,1:PMODE1:H
S=300:PLAY"V0":DIM D(9,4)
5 DRAW"BM15,80R20U20L20U20R20BM4
5,80U40R20D20L20BM75,80U40R20D40
U20L20BM105,80R20L20U10E20U10L20
":GOTO7
6 DRAW"BM135,80U40F10E10D40BM165
,80U40R20D40L20BM195,80U40R20D20
L20F20BM225,80U40R20L20D40R20U20
L5"
7 H=H+1:L=L+1:IFH>29THEN9ELSEPLA
Y"V+T255L255DA":R=RND(3):R=R+5:C
OLORR:IFL=5THENL=1:IFH=29THENPMO
DE3,1
8 IFL=1THEN5ELSEIFL=2THENCOLOR5:
GOTO5ELSEIFL=3THEN6ELSEIFL=4THEN
COLOR5:GOTO6
9 O=O+1:IFO>1THENPLAY"O1L8T8V24A
BCDEFGO2ABCDEFGO3ABCDEFGO4ABCDEF
GO5ABCDEF":GOTO10ELSEIFO=1THEN6

```

```

10 PMODE4:PCLS5:PMODE2:SCREEN1,2
:PS=RND(8):PT=RND(8):MP=RND(8):G
M=6:GN=6:HM=15:TM=0:G=5:K=1:R=9:
C=0:DI=0:F=5:CLS5:Z=5:Y=15:X=296
7:S=2968:MS=2968:J=2968:I=20:GOS
UB11:GOTO26
11 PLAY"V0":W=0:MP=R
12 PLAY"O1L20T20V+ABCDEFG":W=W+1
:IFW<10THEN12
13 W=0:PLAY"V1":D(1,1)=0:D(1,2)=
1:D(1,3)=1:D(1,4)=0:D(2,1)=0:D(2
,2)=1:D(2,3)=1:D(2,4)=1:D(3,1)=0
:D(3,2)=0:D(3,3)=1:D(3,4)=1:D(4,
1)=1:D(4,2)=0:D(4,3)=1:D(4,4)=1:
D(5,1)=1:D(5,2)=0:D(5,3)=0:D(5,4
)=1:D(6,1)=1:D(6,2)=1:D(6,3)=0:D
(6,4)=1:D(7,1)=1
14 D(7,2)=1:D(7,3)=0:D(7,4)=0:D(
8,1)=1:D(8,2)=1:D(8,3)=1:D(8,4)=
0:D(9,1)=1:D(9,2)=1:D(9,3)=1:D(9
,4)=1:IFTM>0THENGOSUB28
15 IFC=5THENPOKES,0:POKES+16,0:P
OKES+32,0:POKES+48,0:S=2968:PS=R
:C=0
16 IFR<>PS THENS=2968
17 RETURN
18 R=1:GOSUB27:GOSUB38:IFY=28THE
NZ=5:Y=1:X=2071:D(1,3)=0:D(8,1)=
0:GOTO25ELSEIFZ=10THENZ=1:Y=15:X
=2963:D(1,2)=0:D(2,4)=0
19 R=2:GOSUB27:GOSUB38:IFZ=1THEN
Z=10:Y=15:X=2972:D(2,4)=0:D(1,2)
=0:GOTO18ELSEIFY=28THENY=1:Z=5:X
=2071:D(2,3)=0:D(9,1)=0:GOTO26EL
SEIFZ=10THENZ=1:Y=15:X=2963:D(2,
2)=0:D(3,4)=0
20 R=3:GOSUB27:GOSUB38:IFZ=1THEN
Z=10:Y=15:X=2972:D(3,4)=0:D(2,2)
=0:GOTO19ELSEIFY=28THENY=1:Z=5:X
=2071:D(3,3)=0:D(4,1)=0
21 R=4:GOSUB27:GOSUB38:IFZ=1THEN
Z=10:Y=15:X=2972:D(4,4)=0:D(9,2)
=0:GOTO26ELSEIFY=1THENY=28:Z=6:X
=3800:D(4,1)=0:D(3,3)=0:GOTO20EL
SEIFY=28THENY=1:Z=5:X=2071:D(4,3
)=0:D(5,1)=0
22 R=5:GOSUB27:GOSUB38:IFY=1THEN
Y=28:Z=6:X=3800:D(5,1)=0:D(4,3)=
0:GOTO21ELSEIFZ=1THENZ=10:Y=15:X
=2972:D(5,4)=0:D(6,2)=0
23 R=6:GOSUB27:GOSUB38:IFY=1THEN
Y=28:Z=6:X=3800:D(6,1)=0:D(9,3)=
0:GOTO26ELSEIFZ=10THENZ=1:Y=15:X
=2963:D(6,2)=0:D(5,4)=0:GOTO22EL
SEIFZ=1THENZ=10:Y=15:X=2972:D(7,

```

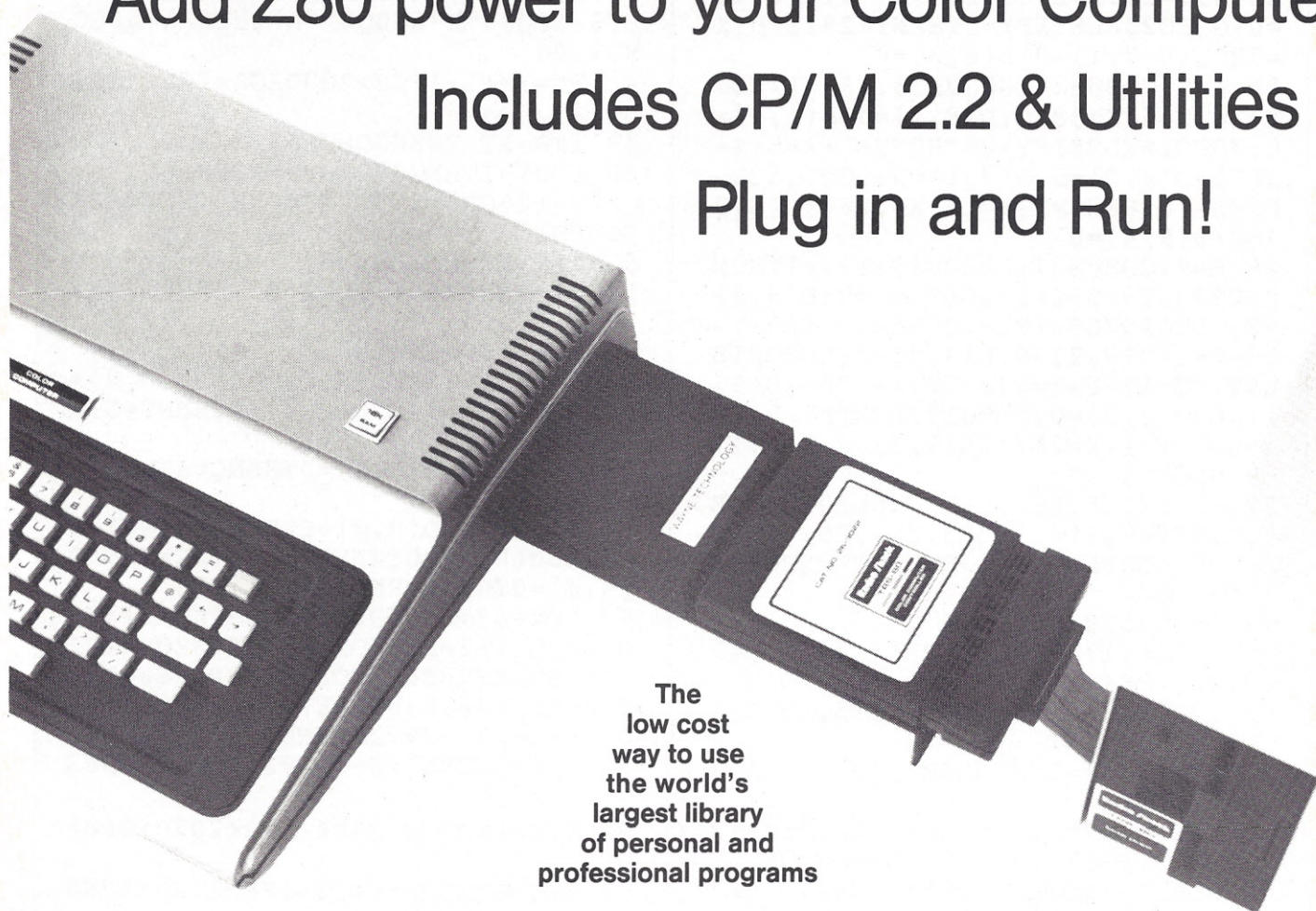
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```

2) = 0: D(6,4) = 0
24 R = 7: GOSUB 27: GOSUB 38: IFZ = 10 THEN
NZ = 1: Y = 15: X = 2963: D(7,2) = 0: D(6,4)
= 0: GOTO 23 ELSE IF Y = 1 THEN Y = 28: Z = 6: X
= 3800: D(7,1) = 0: D(8,3) = 0
25 R = 8: GOSUB 27: GOSUB 38: IF Y = 1 THEN
Y = 28: Z = 6: X = 3800: D(8,1) = 0: D(1,3) =
0: GOTO 18 ELSE IF Y = 28 THEN Y = 1: Z = 5: X =
2071: D(8,3) = 0: D(7,1) = 0: GOTO 24 ELSE
IF Z = 10 THEN NZ = 1: Y = 15: X = 2963: D(8,2
) = 0: D(9,4) = 0
26 R = 9: GOSUB 27: GOSUB 38: IFZ = 1 THEN
X = 2972: Y = 15: Z = 10: D(9,4) = 0: D(8,2)
= 0: GOTO 25 ELSE IF Z = 10 THEN X = 2963: Y =
15: Z = 1: D(9,2) = 0: D(4,4) = 0: GOTO 21 ELSE
IF Y = 1 THEN Z = 6: Y = 28: X = 3800: D(9,
1) = 0: D(2,3) = 0: GOTO 19 ELSE IF Y = 28 THEN
Z = 5: Y = 1: X = 2071: D(9,3) = 0: D(6,1)
= 0: GOTO 23
27 PMODE 2: PCLS: PLAY "V20L20T2003E
": LINE(47,150)-(208,30), PSET, B: C
OLOR 0: SCREEN 1, 1: IFR = PT THEN POKE 6
5314, 150
28 IF HD > 5 THEN COLOR 5
29 IFD(R,1) = 1 THEN LINE(115,30)-(1
45,30), PSET
30 IFD(R,3) = 1 THEN LINE(115,150)-(
145,150), PSET
31 IFD(R,4) = 1 THEN LINE(47,75)-(47
,105), PSET
32 IFD(R,2) = 1 THEN LINE(208,75)-(2
08,105), PSET: IFTM < 2 THEN RETURN
33 PLAY "V1502L255T255GECA01GECA"
: RETURN
34 V = JOYSTK(0): W = JOYSTK(1): RETUR
N
35 IF PEEK(341) = 247 THEN W = 0 ELSE IF P
EEK(342) = 247 THEN W = 63 ELSE W = 32
36 IF PEEK(343) = 247 THEN V = 0 ELSE IF P
EEK(344) = 247 THEN V = 63 ELSE V = 32
37 RETURN
38 T = X: IFR = PS THEN GOSUB 53
39 IFQ = 1 THEN GOSUB 34 ELSE GOSUB 35
40 IFV < 5 THEN X = X - 1: Z = Z - 1 ELSE IFV = >
55 THEN X = X + 1: Z = Z + 1
41 IFW < 5 THEN X = X - 64: Y = Y - 1 ELSE IFW >
55 THEN X = X + 64: Y = Y + 1
42 IFGA = 1 THEN GOSUB 102
43 IFZ < 1 THEN X = X + 1: Z = Z + 1: IFY < 20 AND
DY > 10 AND D(R,4) = 1 THEN RETURN
44 IFZ > 10 THEN X = X - 1: Z = Z - 1: IFY < 20 AND
NDY > 10 AND D(R,2) = 1 THEN RETURN
45 IFY < 1 THEN Y = Y + 1: X = X + 64: IFZ > 4 AND
DZ < 7 AND D(R,1) = 1 THEN RETURN
46 IFY > 28 THEN Y = Y - 1: X = X - 64: IFZ > 4 AND
NDZ < 7 AND D(R,3) = 1 THEN RETURN

```

```

47 POKET, 0: POKET + 32, 0: POKET + 64, 0
: POKET + 96, 0: POKE X, 24: POKE X + 32, 12
6: POKE X + 64, 24: POKE X + 96, 36: Q$ = INK
EY$: IFQ$ < "Z" AND Q$ > "A" THEN F5 = 5: GO
SUB 100
48 TM = TM + 1: IFTM > 200 OR GA = 1 THEN GOS
UB 72
49 IFR = PT THEN GOSUB 68
50 IFDI = 1 THEN 88 ELSE B = PEEK(65280)
: IFB = 126 OR B = 254 OR Q$ = CHR$(32) THEN
GOSUB 11
51 IFC = 5 THEN GOSUB 84
52 RT = RND(200): IF RT = 50 THEN 81 ELSE
38
53 E = S: IFC > 0 THEN 57
54 C = RND(4): IFD(R,1) = 0 AND D(R,2) =
0 AND D(R,3) = 0 AND D(R,4) = 0 THEN C = 5: G
OTO 61
55 IFC = 1 AND D(R,1) = 0 THEN C = RND(3):
C = C + 1
56 IFC = 2 AND D(R,2) = 0 THEN 54 ELSE IF C
= 3 AND D(R,3) = 0 THEN 54 ELSE IF C = 4 AND
D(R,4) = 0 THEN C = RND(3): GOTO 55
57 IFX + 48 = S + 32 OR X + 48 = S + 16 OR X + 48 =
S + 48 OR X + 32 = S + 16 OR X + 32 = S + 32 OR X + 32
= S + 48 THEN 90 ELSE POKEE, 0: POKEE + 16,
0: POKEE + 32, 0: POKEE + 48, 0: IFC = 2 THE
NS = S + 1: IFS > 2972 THEN 62
58 IFC = 4 THEN S = S - 1: IFS < 2963 THEN 63

59 IFC = 1 THEN S = S - 96: IFS < 2070 THEN 6
4
60 IFC = 3 THEN S = S + 96: IFS > 3800 THEN 6
6
61 PLAY "O4;L255T255V3B": POKEE + 48
, 0: POKES, 56: POKES + 16, 16: POKES + 32
, 56: POKES + 48, 40: RETURN
62 C = 0: IFR = 9 THEN PS = 4: S = 2968: RETU
RN ELSE IF R = 8 THEN PS = 9: S = 2968: RETU
RN ELSE IF R > 0 AND R < 3 THEN PS = PS + 1: S =
2968: RETURN ELSE PS = PS - 1: S = 2968: RE
TURN
63 C = 0: IFR = 9 THEN PS = 8: S = 2968: RETU
RN ELSE IF R < 4 AND R > 1 THEN PS = PS - 1: S =
2968: RETURN ELSE IF R = 4 THEN PS = 9: S =
2968: RETURN ELSE IF R > 4 AND R < 7 THEN P
S = PS + 1: S = 2968: RETURN
64 IFR = 8 THEN PS = 1 ELSE IF R = 9 THEN PS =
2 ELSE IF R = 4 THEN PS = 3 ELSE IF R = 7 THEN P
S = 8 ELSE IF R = 6 THEN PS = 9 ELSE IF R = 5 THE
N PS = 4
65 S = 2968: C = 0: RETURN
66 IFR = 4 THEN PS = 5 ELSE IF R = 9 THEN PS =
6 ELSE IF R = 8 THEN PS = 7 ELSE IF R = 3 THEN P
S = 4 ELSE IF R = 2 THEN PS = 9 ELSE IF R = 1 THE
N PS = 8

```

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Color Computer/49


```

67 S=2968:C=0:RETURN
68 J2=J:IFX-J>0ANDX-J<10THENJ=J+
1ELSEIFJ-X>0ANDJ-X<10THENJ=J-1
69 IFJ<X THEN J=J+64ELSEIFJ>X TH
EN J=J-64
70 IFX=J THENDI=1
71 PLAY"O1L255T255V10E":POKEJ2,0
:POKEJ2+32,0:POKEJ2-32,0:POKEJ,2
4:POKEJ+32,36:POKEJ-32,36:RETURN

72 IFTM=201THENSOUND200,1ELSEIFT
M<8THENRETURN
73 GM=GN:IFR=MP THEN75ELSEL=L+1:
IFL>I THENL=0:GM=5:MP=MP+1:IFMP=
10THENMP=1
74 RETURN
75 SM=MS:RT=RND(2):IFRT=1THENRT=
96ELSEIFRT=2THENRT=64
76 IFZ<GM THENMS=MS-1:GM=GM-1:GO
TO77ELSEIFZ>GM THENMS=MS+1:GM=GM
+1
77 IFX<MS THENMS=MS-RT:HM=HM-1EL
SEIFX>MS THENMS=MS+RT:HM=HM+1
78 IFGM<1THENGGM=GM+2:MS=MS+2ELSE
IFGM>10THENGGM=GM-2:MS=MS-2
79 IFMS=XORMS=X+16ORMS=X+32ORMS=
X+48ORMS=X+64ORMS=X+96ORMS+64=X+
32ORMS+64=X+64ORMS+96=X+32ORMS+9
6=X+64ORMS+96=X+96THENDI=1
80 PLAY"O2L255T255V24AB":POKESM,
0:POKESM+32,0:POKESM+64,0:POKESM
+96,0:POKESM+128,0:POKEMS,68:POK
EMS+32,84:POKEMS+64,16:POKEMS+96
,40:POKEMS+128,84:GN=GM:RETURN
81 RZ=R:R=RND(9):RN=RND(2):IFRN=
1THENGH=141ELSEIFRN=2THENGH=135
82 C=0:IFRZ<>R THENS=2968
83 PLAY"V24":FG=0:POKE65314,GH:G
OTO107
84 C=0:IFX=SORX=S+16ORX=S+32ORX=
S+48ORX+64=SORX+64=S+16ORX+64=S+
32ORX+64=S+48ORX+48=SORX+48=S+16
ORX+48=S+32ORX+48=S+48ANDK=0THEN
90
85 M=RND(40):E=S:IFM<10THENS=S+1
:G=G+1ELSEIFM>30THENS=S-1:G=G-1E
LSEIFM>10ANDM<20THENS=S-32ELSEIF
M>20ANDM<30THENS=S+32
86 IFG<2THENS=S+1:G=G+1ELSEIFG>8
THENS=S-1:G=G-1
87 K=0:POKEE,0:POKEE+16,0:POKEE+
32,0:POKEE+48,0:RETURN
88 PLAY"O5":U=0
89 PLAY"O-L255T255V20GFEDCBA":U=
U+1:IFU=4THENCLS4:PRINT@74,"YOU
LOSE!!!":GOTO95ELSE89

```

```

90 CLS3:PLAY"O1":O=0:PRINT@75,"Y
OU WIN!!";
91 PLAY"O+V20L8T8EP8EP8EP8L2E":O
=O+1:IFO=4THENELSE91
92 PRINT@166,"YOUR TIME WAS:"TM/
2;:IFTM/2<40THENPRINT@298,"EXPER
T!!!!";PLAY"V24L7T7O3DP32DP32D
P32L3T3G"ELSEIFTM/2>39.99ANDTM/2
<80THENPRINT@300,"AVERAGE ";ELSE
IFTM/2>79.99THENPRINT@301,"NOVIC
E";
93 FORX=1TO1500:NEXTX:IF TM/2<HS
THENHS=TM/2
94 CLS3:PRINT@199,"BEST TIME:"HS
;:FORX=1TO500:NEXTX:CLS4
95 PRINT@199," PLAY AGAIN? "
;:PRINT@263," GAME (1,2,3)? ";
:SCREEN0,1
96 HD=0:F$=INKEY$:P=PEEK(65280):
IFP=126ORP=254THEN10ELSEIFF$="Y"
THEN10ELSEIFF$="N"THEN98ELSEIFF$
="1"THENGA=0:I=20:SOUND1,1ELSEIF
F$="2"THENGA=1:I=20:SOUND81,1ELS
EIFF$="3"THENGA=1:I=1:SOUND127,1
ELSEIFF$="J"THEN0
97 GOTO96
98 IFHS=300THENHS=0
99 CLS8:PRINT@199,"BEST TIME:"HS
;:PLAY"L6T6V24O3ACDL4T4GP16GO4L6
T6ACDL4T4GP16O5L6T6ACDL4T4GEL2T4
G":CLS0:END

100 COLORF:DRAW"BM70,170U10R4D5L
4R4D5L4BM80,170U5L2U5D5R5U5BM105
,170U10R4D10U5L4BM118,170U10R4L4
D5R4L4D5R4BM135,170U10R4D5L4R4D5
L4BM145,170U10R4D10L5BM155,170U1
0R4L4D10R4U4L1BM165,170U10R2F2D6
G2L2BM175,170U10R4D10U5L4BM185,1
70U10F2D6F2U10"
101 IFF=0THENRETURNELSEPLAY"T5L5
V24O2ABDDP16DBAAP16O1ABDDDBAAABC
DEFGO2ABCDEFGO3ABCDEFGGGG":F=0:G
OTO100
102 HD=HD+1:IFHD>10THENHD=0
103 COLOR0:NB=0:IFHD>5THENCOLOR5
:NB=1
104 IFHD=1ORHD=6THENGOSUB29
105 IFNB=1ANDY<1THENY=Y+1:X=X+64
ELSEIFNB=1ANDY>28THENY=Y-1:X=X-6
4ELSEIFNB=1ANDZ<1THENX=X+1:Z=Z+1
ELSEIFNB=1ANDZ>10THENX=X-1:Z=Z-1

106 RETURN
107 PLAY"O1L255T200V-AEGBDCF":FG
=FG+1:IFFG=23THENONR GOTO18,19,2
0,21,22,23,24,25,26ELSE107 ■■■

```


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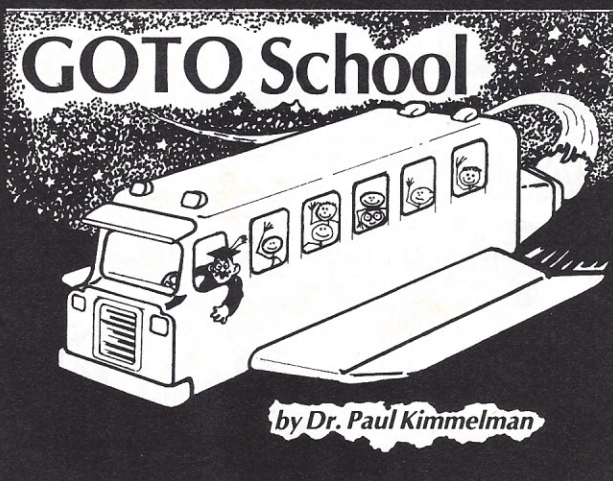


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IMAGINE A CLASSROOM without textbooks; students and teachers work on school assignments with a home computer when absent from school. Better yet, what about going to an electronic university? While some of this may sound far-fetched, these scenes are now a reality.

Consider the recent announcement by TeleLearning Network (based in San Francisco): it will offer 170 correspondence courses by computer. TeleLearning President Ron Gordon predicts that within three years his company will educate more people than any other private educational institution in the world. None of the current course offerings from TeleLearning are accredited; however, Secretary of Education Terrel Bell attended the press conference that launched the company, lending a certain amount of legitimacy to the concept. In fact, Bell stated, "The thrilling thing about the concept of the Electronic University is its flexibility and adaptability, as far as its ability to reach all learners on all levels and then to teach them where they are, and then to individualize the instruction for each and every student."

This is just the first of what could become a widespread use of home computers for education via a database. Databases don't have to remain at home, however; schools should also be able to take advantage of databases with their computers.

A database is nothing more than a large file of information used with a computer system. Don't let that definition fool you, though; once you hook your computer to a modem and can access a large database (like CompuServe), you have opened a window to a phenomenal volume of information.

Suppose you need to access information normally contained in an encyclopedia. One feature of CompuServe's database is Grolier's *Academic American En-*

cyclopedia. Students may use this feature of a database to enhance their research reports.

Databases may also be used for information exchange. Where it used to require a long distance phone call, or several days to exchange letters, to discuss an education project, it is now possible to share information in minutes via "electronic mail." From California to Maine, students can communicate their ideas almost instantaneously.

Last minute updates can be included in research reports through database use. A student researching a Senate committee hearing may be able to access the latest information from the Washington Post government menu. The information available via database is limitless.

Database use doesn't require lots of expensive equipment. Your computer and monitor were the largest investment; now all you need is a modem and terminal software. Beware, however, that most databases charge a fee based on the amount of time you spend on line.

At School

Let's look first at CompuServe, and what it was like to be a student at its Information Provider School. I went to the two-day school to learn how the infor-

mation you access on CompuServe is sent. Being a student and not a teacher was an enlightening role change for me. Our class was warned that two days was barely enough time to cover the information, and we would be working hard. The huge notebook placed at each seat added weight to this warning.

I was proud to represent my school district and **The Color Computer Magazine**. I soon discovered I was among top-level students. Representatives from Tandy, Educational Research Information Center (ERIC), Digital Research, Grolier's *Academic American Encyclopedia*, Social Security, Library of Congress, CompuServe, and even the Internal Revenue Service were present.

One participant was deaf and blind; a companion typed the class proceedings on a keyboard which transmitted the material to the blind student in braille. This classmate has been developing files for blind people to use that are available through The Library of Congress.

We were introduced to officials from CompuServe and our two teachers, Mary Beth Finley and Lynn Galli, who have a fine command of "computerese," which made me reflect on the ways computer technology has butchered the English language. Mary Beth and Lynn introduced us to words like Filge, RUNF10, navigational, menu, tree, own, page and files. As I reflect on the common words, I wonder if we might have better created new words for computer technology.

Our first task was to define *videotex*. Basically, videotex can be used to describe any text displayed over a video screen. Each screen represents one page of information. To put this in context, CompuServe contains more than half a million pages of information.

Our first day was devoted to a program called Filge, or in English: File Generator and Editor. Filge is an easy-to-use program that creates and edits files. For a definition, consider a *file* a collection of data uniquely identified by a name and extension. We were given "hands-on" computer time to work with the program; our first assignment was to develop files for a restaurant menu. We were given a list of 50 food items and beverages and told to arrange them so a CompuServe user could access them easily. My partner and I found this to be an easy task, and arranged our main menu into beverages, appetizers, main courses, salads, and desserts (see Figure 1).

Filge was just the first step; the next was RUNF10, a strange name for a text-formatting program which produces output files with specified features. Output

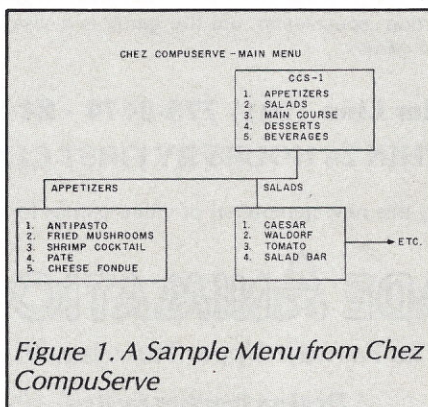


Figure 1. A Sample Menu from Chez CompuServe

files are 32 characters wide and 12 lines in length. Other features of the RUNF10 program include justified or ragged right margins, page size and line length control, paragraphing, right, left or centering text, and page headings and footings.

Finally we used Framer, an interactive menu-formatted system used to view textual information. Framer is the final step before a CompuServe user accesses information placed in the database.

The content of these programs is not significant; what is important is that one can become an information provider easily. Electronic retrieval of information is just beginning to emerge as an important source for educators. Heretofore, outdated books or even days-old magazines were the best and most up-to-date materials available to teachers. Television and newspapers provide current events, but are limited to the stories selected by editors.

Databases free teachers and students to communicate electronically. Our entire country could be networked; teachers on the west coast could provide information for students on the east coast, and vice-versa. Electronic pen pals could work on small group projects together. Teachers may even now be able to supplement their lesson plans with information from teachers they have never met.

It could be possible to link all state departments of education. Ohio's current major education project, for example, is to implement new minimum standards. Teachers in other states would be able to review these standards through a database, make comparisons to their own state standards, and draw their own conclusions. Each state's educational theme could become a part of every state's effort. No, I am not suggesting a federal system of education, but rather an opportunity to share each state's ideas through electronic media.

The ease with which one can become an information provider to a database convinces me this application has a major implication for the future of education. Yes, there will still be programming classes, computer assisted instruction, and even games, but the database opens a new door to the computer literacy curriculum.

Next month: a summary of a major study on children and electronic text sponsored by The National Institute of Education. Does the "electronic text system represent a second electronic revolution in the industrialized nations?" Where are children using electronic text systems, and how?

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4K Color Basic

BEEN THINKING OF TRYING CompuServe or a bulletin board service but don't want to invest in expensive software? Is your software inadequate for communicating with your mainframe? Here is a program that will turn your Color Computer into a terminal suitable for telecommunications with any host computer.

I wrote CCTerm to get around the limitations of Radio Shack's Videotex when I was working with the mainframe at my office. Videotex can't send a true break (a string of nulls) or a rubout (ASCII \$7F), nor can it send or receive lowercase characters. My program will give you the full set of 128 ASCII characters (as shown in Table 1) and will also let you define the function of certain special keys on your keyboard.

CCTerm does have limitations. It is a dumb terminal program, in that it will neither upload nor download files from the host, and it does not store any received data. Also, it retains the 32-character-per-line display. However, features could easily be added if you have the memory and an assembler.

Understanding Serial

To understand how the program works, a review of serial telecommunications is in order. When two computers communicate over the telephone, two lines are available, one for each system to transmit on. Binary words must be sent serially, i.e., one bit at a time, one after the other. The actual conversion of binary information to tones on the telephone line is accomplished by a device called a *modem* (modulator/demodulator). So, you must have a modem, in addition to the terminal software program, to communicate over the phone.

RS-232 is the recognized standard for serial communications between a computer and a peripheral (such as a modem). The format for a typical serial word is shown in Figure 1. It normally consists of one start bit, seven data bits (eight for

by Richard Campbell

graphics), a parity bit and a stop bit. The time length of each bit is determined by the data rate. Therefore, 300 baud (the most common rate) defines one bit as being 3.33 ms (milliseconds) long. One 10-bit serial word would require 33.3 ms for transmission.

Parity is used to check the validity of received data. Parity may be defined as even or odd, and refers to the number of high bits (binary 1) in a word. For example, binary 1001000 (ASCII character H) has an even number of high bits. For even parity, the parity bit would be set low, and set high for odd parity.

The Program

The most common RS-232 combination in use today (including CompuServe and most bulletin boards) is 300 baud with even parity at full duplex. (Full duplex simply means that both systems can transmit data to the other at the same time.) CCTerm is set up to function in just that way (although you can change the parity and duplex if necessary). You cannot change the baud rate (if you want to work at 600 baud or higher, the cost of your software is not your big expense, anyway).

Radio Shack did not include a UART (Universal receiver/transmitter) or an ACIA (asynchronous communications interface adaptor) in the Color Computer. Either of these devices would automatically

handle all of the serial timing problems. Instead, the serial words must be created by the Color Computer's software and transferred one bit at a time via the peripheral interface adaptor (PIA).

In the Color Computer the RS-232 input is connected to bit zero of address \$FF22, while RS-232 output is on bit one of \$FF20. The software must read from or write to the PIA every 3.33 ms while manipulating a serial word to maintain the correct baud rate. Because the 6809E microprocessor runs at 1.12 microseconds per cycle, it has plenty of time to execute thousands of cycles between the transmission of each bit.

The program remains in a short executive loop, continuously looking for a key pressed on the keyboard or the start bit of an incoming word. When either is detected the program branches to the appropriate subroutine to receive the ASCII word and display it on the screen, or transmit the character at the proper baud and parity.

Subroutine Sender rolls each bit in succession into the b1 position for output to address \$FF20. Subroutine Recv reads from address \$FF22 and rolls b0 into the carry bit. Each bit is rolled into memory from the carry sequentially to build up the complete word.

If you have disassembled your Basic ROM (or read Jake Commander's article in **The Color Computer Magazine**, July 83), you will notice a similarity between the Polcat and ChROUT subroutines in this program and those in the ROM. I have downloaded these routines to modify them for adaptability to this program. Because we already own the ROM, and

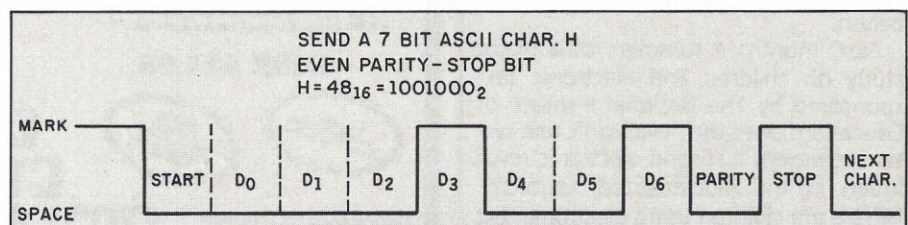
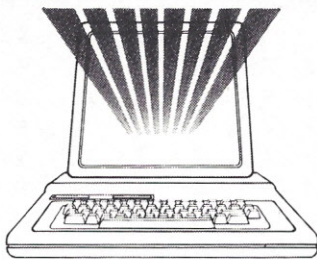


Figure 1. RS-232 Serial Format (300 Baud)

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PRINT @ IS FULLY IMPLEMENTED

The PRINT @ statement is a valuable asset to the programmer when formatting text on the screen. The standard Color Computer will report an error if you specify a location higher than 511 but Super Screen allows locations all the way to 1223! You get a big screen and a powerful formatting tool as well. Of course, Super Screen also supports the CLS command allowing you to clear the big screen using standard Basic syntax.

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That's right! Super Screen gives you a full implementation of ON ERROR GOTO including the ERR and ERL functions. Now you can trap errors and take corrective action to prevent crashed programs and lost data using the same standard syntax as other computers. The ON ERROR GOTO capability overcomes a serious deficiency of Color Computer Basic and greatly improves your capability to handle sophisticated tasks. All well written, 'user friendly' programs use error trapping techniques and yours can too! Now that's power!

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No more frustration as you edit a long line in your Basic program; just hold the space bar down and automatically step to the desired position in the line. Need a line of asterisks? Hold the key down and auto repeat will give them to you. Those of you who spend many hours at your keyboard will appreciate this outstanding addition to Super Screen's long list of impressive capabilities.

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Super Screen recognizes several special control code characters that allow selection of block or underline, solid or blinking cursor and other functions. You can 'Home Up' the cursor or you may erase from the cursor to the end of a line or to the end of the screen just like many other computers. These special codes give you an extra dimension of versatility and convenience that put Super Screen in a class by itself.

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The MDP order entry system is a family of programs which operate interactively by means of a "menu" selection scheme. Up to 900 products may be defined and a single disc system can hold over 600 transactions. When the operator selects a task to be performed, the computer loads a program designed to handle that task from the system disc. The system disc contains all of the programs required to create, update and maintain data files and prepare the necessary paperwork including shipping and invoice forms, daily sales reports, a monthly (or other period) sales report and a receivables report.

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because we are not reselling the software, we are not violating any copyrights. I'm merely showing you how to modify the routines for your own, personal use.

The Polcat code was modified to include a control key function (the Down Arrow). This key acts like the shift key to send the control characters A-Z by simultaneously pressing the Down Arrow and the desired key. Also, the keyboard table is now available for modification to send any character you desire. By comparing the keyboard table in the Program Listing to the key function chart in Table 2 you can see how this is accomplished. I have set up the special keys to return certain ASCII values. For example, the Left Arrow key now returns a rubout (\$7F) instead of a backspace (\$08). To send a backspace just key the control key and h. The Break key value was changed to flag a special break routine (long null) instead of control key and c.

Upon assembly or POKEing the program, you may make any changes to the table you desire. You might want to add an escape key (ASCII \$1B) to the table, say on the shifted Break key at address \$3F54. CompuServe, for example, does not use a true break but uses control c. You could then change the value in address \$3F53 from \$80 to \$03 if you were

Bits 4 through 6		0	1	2	3	4	5	6	7
0	NUL	DLE	SP	0	@	P		P	
1	SOH	DC1	!	1	A	Q	a	q	
2	STX	DC2	"	2	B	R	b	r	
3	ETX	DC3	#	3	C	S	c	s	
4	EOT	DC4	\$	4	E	T	d	t	
5	ENQ	NAK	%	5	D	U	e	u	
Bits 0 through 3		6	ACK	SYN	&	6	F	V	
7	BEL	ETB	'	7	G	W	g	w	
8	BS	CAN	(	8	H	X	h	x	
9	HT	EM	)	9	I	Y	i	y	
A	LF	SUB	*	:	J	Z	j	z	
B	VT	ESC	+	;	K	[	k		
C	FF	FS	,	<	L	/	l	/	
D	CR	GS	-	=	M	]	m		
E	SO	RS	.	>	N		n		
F	SI	US	/	?	O		o	DEL	

Table 1. ASCII Character Set

only going to work with them. Complete uppercase and lowercase is available and is selected by hitting the shift and zero keys as always.

For the display, the ROM ChROUT routine also required modification to speed up the scrolling function to solve some timing problems. And in addition, I have

selected a black screen with green letters (personal preference). I can achieve a crisp monotone display on my color TV by turning off the color and readjusting the TV controls for a very readable display. If you prefer the green screen/black letters, the program is easily changed. Replace the EORA #\$40 instruction at label

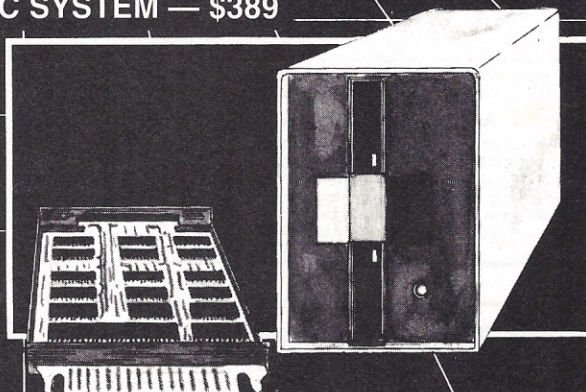
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Key	ASCII(hex)	Symbol	Function
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shift	5F		underscore
	00	cntl	control key
shift	5B	[	—
	7F	rub	char. delete
shift	18	cntl-X	line delete
	09	cntl-I	tab
shift	5D	]	—
SPACEBAR	20		space
0	30	0	—
shift 0	12	cntl-R	case switch
ENTER	0D	cntl-M	carr. ret.
CLEAR	0C	cntl-L	form feed
shift clear	5C		backslash
BREAK	80		break
shift BREAK	80		break
@	40	@	—
shift @	13	cntl-S	pause

Table 2. CC Term Key Functions

B6 (address \$3FBB) with two NOPs (\$12). Then change all \$20 to \$60 at addresses \$3DDD, \$3F84, \$3F90, \$3FCF, \$3FD0 and \$3FD9 (the code for "space"). Then change the cursor value at address \$3FE0 to \$7F, also.

Finally, to switch from the default conditions of even parity or full duplex, change the value stored at label Duplex or Parity (address \$3E1E or \$3E1F) from \$0 to \$FF in subroutine Sender. No re-assembly would be required.

Assembling and Running

As assembled, a 16K machine is required. However, because the program takes only 533 bytes and the code is relocatable, it can easily be loaded into a 4K machine. Once the machine code is loaded, be sure to double check your typing and then save to tape or disk before running. To begin, enter EXEC&H3DD0. The screen will clear and the message PLACE CALL will appear. This is your cue to dial your host computer and turn on the modem. The program is already in its executive loop and is ready to send and receive. You will need to be familiar with the operating instructions of your host to continue. To exit the program, just reset the Color Computer. Be sure to log off from your host first! ■ ■ ■

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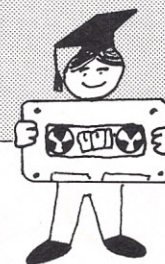
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DR. ADLIB — helps teach parts of speech and reinforces by using them in sentences created by the child. Req. 16K. **Cassette:** \$19.95 **Disk:** \$25.95

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Program Listing. CC Term

		00001 *	CCTERM		
		00002 *			
		00003 *	TERMINAL		
		00004 *	COMMUNICATIONS		
		00005 *	FOR THE TRS80C		
		00006 *	BY		
		00007 *	R. W. CAMPBELL		
		00008 *			
		00009 *	300 BAUD		
		00010 *	FULL DUPLEX		
		00011 *	EVEN PARITY		
		00012 *			
	FF20	00013	PIAOUT EQU	\$FF20	
	FF22	00014	PIAIN EQU	\$FF22	
		00015 *			
3DD0		00016	ORG	\$3DD0	
3DD0 1A	50	00017	START ORCC	\$50	
3DD2 86	FF	00018	LDA	\$FF	
3DD4 B7	FF20	00019	STA	PIAOUT	RS232 OUT SET HIGH
3DD7 8E	0400	00020	LDX	\$400	
3DDA 9F	88	00021	STX	<\$88	BEGIN VIDEO ADDRESS
		00022 *			
		00023	*CHANGE \$20 TO \$60		
		00024	*IN NEXT LINE TO		
		00025	*INVERT VIDEO		
		00026 *			
3DDC 86	20	00027	LDA	\$20	CLEAR SCREEN
3DDE A7	80	00028	CLEAR STA	,X+	
3DE0 8C	0600	00029	CMPX	\$600	END OF SCREEN?
3DE3 26	F9	00030	BNE	CLEAR	
3DE5 30	8D 000D	00031	LEAX	MSG1,PCR	GET MSG ADDR
3DE9 A6	80	00032	LOOP1 LDA	,X+	PRINT MSG1
3DEB 81	04	00033	CMPA	\$4	DONE?
3DED 1027	016F	00034	LBEQ	EXEC	GOTO EXECUTIVE
3DF1 17	0181	00035	LBSR	CHROUT	
3DF4 20	F3	00036	BRA	LOOP1	UNTIL MSG DONE
		00037 *			
3DF6 504C41434520		00038	MSG1 FCC	/PLACE CALL/	
43414C4C					
3E00	0D04	00039	FDB	\$0D04	CR, END
		00040 *			
		00041	*POLL ROUTINE		
		00042 *			
3E02 17	008C	00043	POLL LBSR	POLCAT	GO TO KEYBOARD
3E05 81	80	00044	CMPA	\$80	BREAK PRESSED?
3E07 26	0A	00045	BNE	NOBRK	
3E09 7F	FF20	00046	CLR	PIAOUT	SET NULL OUT
3E0C 86	09	00047	LNGTIM LDA	\$9	COUNTER
3E0E 8D	04	00048	BRK	BSR	TIMER
3E10 4A		00049	DECA		
3E11 2A	FB	00050	BPL	BRK	WAIT 10 BITS, THEN A=\$FF
3E13 39		00051	NOBRK RTS		
		00052 *			
		00053	*3.3 MSEC TIMER		
		00054 *			
3E14 8E	0146	00055	TIMER LDX	\$146	
3E17 30	82	00056	TIMERX LEAX	, -X	DECR X
3E19 26	FC	00057	BNE	TIMERX	
3E1B 39		00058	RTS		
		00059 *			

3E83	81	00	00121	CMPA	#0	NULL?
3E85	27	07	00122	BEQ	DONE	
3E87	81	7F	00123	CMPA	#\$7F	RUBOUT?
3E89	27	03	00124	BEQ	DONE	
3E8B	17	00E7	00125	LBSR	CHROUT	PUT ON SCREEN
3E8E	39		00126	DONE	RTS	
			00127	*		
			00128	*KEYBOARD POLL		
			00129	*		
3E8F	35	94	00130	L3	PULS	PC,X,B
3E91	34	54	00131	POLCAT	PSHS	U,X,B
3E93	8D	03	00132		BSR	L1
3E95	4D		00133		TSTA	CHECK KYBD
3E96	35	D4	00134		PULS	PC,U,X,B
3E98	CE	FF00	00135	L1	LDU	PIA ADDRESS
3E9B	8E	0152	00136		LDX	\$152
3E9E	4F		00137		CLRA	ROLLOVER BITS
3E9F	4A		00138		DECA	
3EA0	34	12	00139		PSHS	X,A
3EA2	A7	42	00140		STA	2,U
3EA4		21	00141		FCB	\$21
3EA5		53	00142	LX	FCB	\$53
3EA6	69	42	00143		ROL	2,U
3EA8	24	E5	00144		BHS	L3
3EAA	6C	60	00145		INC	0,S
3EAC	8D	60	00146		BSR	L4
3EAE	A7	61	00147		STA	1,S
3EB0	A8	00	00148	EORA	0,X	MAKE ROLLOVER BITS
3EB2	A4	00	00149	ANDA	0,X	
3EB4	E6	61	00150	LDB	1,S	
3EB6	E7	80	00151	STB	,X+	
3EB8	4D		00152	TSTA		
3EB9	27	EA	00153	BEQ	LX	
3EBB	E6	42	00154	LDB	2,U	
3EBD	E7	62	00155	STB	2,S	SAVE FOR BOUNCE CHECK
3EBF	C6	F8	00156	LDB	#\$F8	
3EC1	CB	08	00157	L5	ADDB	#8
3EC3	44		00158		LSRA	
3EC4	24	FB	00159	BHS	L5	GET CHAR.
3EC6	EB	60	00160	ADDB	0,S	
3EC8	27	4F	00161	BEQ	L6	
3ECA	C1	1A	00162	CMPB	#\$1A	CHAR > Z?
3ECC	22	4D	00163	BHI	L7	YES, GO TO TABLE
3ECE	17	0086	00164	LBSR	CNTL	CNTL KEY DOWN TOO?
3ED1	27	0D	00165	BEQ	LX1	YES
3ED3	CA	40	00166	ORB	#\$40	NO, ADD OFFSET
3ED5	8D	2C	00167	BSR	L8	SHIFT ALSO?
3ED7	27	07	00168	BEQ	LX1	YES
3ED9	B6	011A	00169	LDA	\$11A	CHECK CASE
3EDC	26	02	00170	BNE	LX1	UPPER CASE ONLY
3EDE	CA	20	00171	ORB	#\$20	ADD LOWER CASE OFFSET
3EE0	E7	60	00172	LX1	STB	0,S
3EE2	BE	011B	00173		LDX	\$11B
3EE5	17	FF2F	00174	LBSR	TIMERX	KYBD DEBOUNCE DELAY
3EE8	C6	FF	00175		LDB	#\$FF
3EEA	8D	20	00176		BSR	L9
3EEC	4C		00177		INCA	
3EED	26	06	00178		BNE	L10


```

00060 *SENDER SUBROUTINE
00061 *
00062 WRDOUT RMB 1
00063 OUTCNT RMB 1
00064 *
00065 *TO SET ODD PARITY
00066 *OR HALF DUPLEX
00067 *CHANGE 0 TO $FF
00068 *AT THAT LABEL
00069 *

3E1C      00      00070 PARITY FCB 0 SETS EVEN PARITY
3E1D      00      00071 DUPLEX FCB 0 SETS FULL DUPLEX
3E20 A7    8C F9  00072 SENDER STA WRDOUT,PCR SAVE OUTPUT CHAR.
3E23 6D    8C F9  00073 TST DUPLEX,PCR
3E26 27    03     00074 BEQ SKIPR IF FULL DUPLEX
3E28 17    014A   00075 LBSR CHROUT IF HALF DUPLEX
3E2B 86    08     00076 SKIPR LDA #8 BIT COUNT
3E2D A7    8C ED  00077 STA OUTCNT,PCR
3E30 4F    08     00078 CLRA SET START BIT
3E31 5F    08     00079 CLRB PARITY CHECKER
3E32 6D    8C E9  00080 TST PARITY,PCR
3E35 27    01     00081 BEQ LOOPA IF EVEN PARITY
3E37 53    01     00082 COMB IF ODD PARITY
3E38 B7    FF20   00083 STA PIAOUT SEND BIT
3E3B 66    8C DE  00084 ROR WRDOUT,PCR PUT FIRST BIT IN CARRY
3E3E 24    01     00085 BHS SKIPR IS IT A 1?
3E40 53    01     00086 COMB SET/UNSET FOR PARITY
3E41 49    01     00087 SKIPB ROLA
3E42 49    01     00088 ROLA CARRY INTO BIT 1
3E43 8D    CF     00089 BSR TIMER TIME IT OUT
3E45 6A    8C D5  00090 DEC OUTCNT,PCR ALL BITS SENT?
3E48 26    EE     00091 BNE LOOPA NO
00092 *FIRST 8 BITS SENT
3E4A 86    FF     00093 LDA #$FF STOP BIT
3E4C F7    FF20   00094 STB PIAOUT PARITY BIT
3E4F 8D    C3     00095 BSR TIMER
3E51 B7    FF20   00096 STA PIAOUT SEND STOP
3E54 8D    BE     00097 BSR TIMER
3E56 6D    8C C6  00098 TST DUPLEX,PCR
3E59 27    02     00099 BEQ SENT IF FULL DUPLEX
3E5B 8D    AF     00100 BSR LNGTIM SKIP ANY ECHO
3E5D 39    01     00101 SENT RTS
00102 *
00103 *RECEIVE SUBROUTINE
00104 *
00105 WRDIN RMB 1
00106 BITCNT RMB 1
00107 RECVR CLR WRDIN,PCR
00108 LDB #7 COUNTER
00109 STB BITCNT,PCR
00110 LDX #S190 GO TO MIDDLE ...
00111 BSR TIMERX .. OF FIRST WORD BIT
00112 LOOPB LDA PIAIN RS232IN, GET THE BIT
00113 ASRA PUT BIT IN CARRY
00114 ROR WRDIN,PCR SAVE IT
00115 BSR TIMER WAIT FOR NEXT BIT
00116 DEC BITCNT,PCR
00117 BNE LOOPB UNTIL 7 BITS READ
00118 ROR WRDIN,PCR NOW @ MIDDLE OF PRTY BIT
00119 LDA WRDIN,PCR GET RECEIVED WORD
00120 ANDA #$7F ERASE PARITY

```

```

3EEF E6    62     00179 LP2 LDB 2,S
3EF1 8D    19     00180 BSR L9 CHECK AGAIN
3EF3 A1    61     00181 CMPA 1,S SAME KEY?
3EF5 35    02     00182 L10 PULS A
3EF7 26    07     00183 BNE L11 NO, SKIP
3EF9 81    12     00184 CMPA #S12 SHIFT 0?
3EFB 26    04     00185 BNE L12 NO
3EFD 73    011A   00186 COM $11A YES, TOGGLE
3F00 4F    08     00187 L11 CLRA
3F01 35    90     00188 L12 PULS PC,X
3F03 86    7F     00189 L8 LDA #$7F CHECK FOR SHIFT
3F05 A7    42     00190 STA 2,U SET COL. 8
3F07 A6    40     00191 LDA 0,U CHECK ROWS
3F09 84    40     00192 ANDA #$40 A=0 IF SHIFT PRESSED
3F0B 39    01     00193 RTS
3F0C E7     01     00194 L9 FCB $E7
3F0D 42     01     00195 LPI FCB $42 FORMS STB 2,U
3F0E A6    40     00196 L4 LDA 0,U
3F10 8A    80     00197 ORA #$80
3F12 6D    42     00198 TST 2,U
3F14 2B    02     00199 BMI L13
3F16 8A    C0     00200 ORA #$C0
3F18 39    01     00201 L13 RTS
3F19 C6    33     00202 L6 LDB #$33
3F1B 30    8C EF  00203 L7 LEAX LP1,PCR TABLE OFFSET
3F1E C1    21     00204 CMPB #$21
3F20 25    16     00205 BLO L14
3F22 30    8C CA  00206 LEAX LP2,PCR TABLE OFFSET
3F25 C1    30     00207 CMPB #$30
3F27 24    0F     00208 BHS L14
3F29 8D    D8     00209 BSR L8
3F2B C1    2B     00210 CMPB #$2B
3F2D 23    02     00211 BLS L15
3F2F 88    40     00212 EORA #$40
3F31 4D     01     00213 L15 TSTA
3F32 27    AC     00214 BEQ LX1
3F34 CB    10     00215 ADDB #$10
3F36 20    A8     00216 BRA LX1
3F38 58     01     00217 L14 ASLB
3F39 8D    C8     00218 BSR L8 CHECK SHIFT
3F3B 26    01     00219 BNE L16 NONE
3F3D 5C     01     00220 INCB INCR TABLE OFFSET
3F3E E6    85     00221 L16 LDB B,X GET TABLE VALUE
3F40 20    9E     00222 BRA LX1 SEND CHAR.
00223 *
00224 *KEYBOARD TABLE
00225 *
00226 FCB 0
00227 FDB $5E5F UP ARROW, SH UP ARROW
00228 FDB $005B DN ARROW, SH DN ARROW
00229 FDB $7F18 L ARROW, SH L ARROW
00230 FDB $095D R ARROW, SH R ARROW
00231 FDB $2020 SPACEBAR
00232 FDB $3012 ZERO, SH ZERO
00233 FDB $0D0D ENTER, SH ENTER
00234 FDB $0C5C CLEAR, SH CLEAR
00235 FDB $8080 BREAK, SH BREAK
00236 FDB $4013 @, SH @
00237 *
00238 CNTL LDA #$EF CNTL KEY CHECK
00239 A7 2,U STA 2,U SET KYBD COL. 5
00240 A6 40 LDA 0,U CHECK ROWS

```



```

3F5D 84 08 00241 ANDA #8 A=0 IF CNTL PRESSED
3F5F 39 00242 RTS
00243 *
00244 *EXEC ROUTINE
00245 *
3F60 17 FE9F 00246 EXEC LBSR POLL LOOK AT KYBD
3F63 81 00 00247 CMPA #0 GOT ONE?
3F65 27 03 00248 BEQ SKIPX NO
3F67 17 FEB6 00249 LBSR SENDER YES, SEND IT
3F6A B6 FF22 00250 SKIPX LDA PIAIN CHECK INCOMING
3F6D 47 00251 ASRA PUT IN CARRY
3F6E 25 F0 00252 BLO EXEC INPUT HIGH?
3F70 17 FEED 00253 LBSR RECV NO, GET INCOMING
3F73 20 EB 00254 BRA EXEC
00255 *
00256 * OUTPUT TO SCREEN
00257 *(INVERTED CHAR.)
00258 *
3F75 34 16 00259 CHROUT PSHS A,B,X
3F77 5F 00260 CLR B
3F78 9E 88 00261 LDX <$88 SET SCROLL FLAG
3F7A 81 08 00262 CMPA #8 CURSOR POSITION
3F7C 26 0B 00263 BNE B1 BACKSPACE?
3F7E 8C 0400 00264 CMPX #$400 TOP OF SCREEN?
3F81 27 55 00265 BEQ B2 THEN DONE
00266 *
00267 *CHANGE $20 TO $60
00268 *IN NEXT LINE TO
00269 *INVERT VIDEO
00270 *
3F83 86 20 00271 LDA #$20 SPACE
3F85 A7 82 00272 STA ,X- BACK UP ONE
3F87 20 29 00273 BRA B3 SAVE POSITION
3F89 81 0D 00274 B1 CMPA #$0D CARRIAGE RET.?
3F8B 26 0E 00275 BNE B4
3F8D 9E 88 00276 LDX <$88
00277 *
00278 *CHANGE $20 TO $60
00279 *IN NEXT LINE TO
00280 *INVERT VIDEO
00281 *
3F8F 86 20 00282 B5 LDA #$20
3F91 A7 80 00283 STA ,X+ CLEAR TO END OF LINE
3F93 1F 10 00284 TFR X,D
3F95 C5 1F 00285 BITB #$1F END OF LINE?
3F97 26 F6 00286 BNE B5 NOE
3F99 20 17 00287 BRA B3 SAVE POSITION
3F9B 81 20 00288 B4 CMPA #$20 CONTROL CHAR.?
3F9D 25 39 00289 BLO B2 YES, SKIP IT
3F9F 4D 00290 TSTA
3FA0 2B 0C 00291 BMI B6 GRAPHICS?
3FA2 81 40 00292 CMPA #$40 SPECIAL CHARS?
3FA4 25 06 00293 BLO B7 YES
3FA6 81 60 00294 CMPA #$60 UPERCASE?
3FA8 25 04 00295 BLO B6 YES
3FAA 84 DF 00296 ANDA #$DF CANCEL OFFSET
3FAC 88 40 00297 B7 EORA #$40 CHAR. OFFSET
00298 *
00299 *CHANGE NEXT TWO
00300 *BYTES TO $12 (NOP)
00301 *TO INVERT VIDEO
00302 *
3FAE 88 40 00303 B6 EORA #$40 INVERT SCREEN

```

```

3FB0 A7 80 00304 STA ,X+ SCREEN IT
3FB2 9F 88 00305 B3 STX <$88 CURSOR POSITION
3FB4 5F 00306 CLR B SET SCROLL FLAG
3FB5 8C 05FF 00307 CMPX #$5FF END OF SCREEN?
3FB8 23 1E 00308 BLS B2 NO SCROLL
00309 *
3FBA 8E 0400 00310 LDX #$400 SCROLL
3FBD EC 88 20 00311 B8 LDD $20,X GET NEXT LINE..
3FC0 EE 88 22 00312 LDU $22,X ..4 BYTES AT A TIME
3FC3 ED 81 00313 STD ,X++ MOVE UP ONE LINE
3FC5 EF 81 00314 STU ,X++
3FC7 8C 05E0 00315 CMPX #$5E0 NEXT TO LAST LINE?
3FCA 25 F1 00316 BLO B8 NOT YET
3FCC 9F 88 00317 STX <$88 LAST SCREEN LINE
00318 *
00319 *CHANGE $20 TO $60
00320 *IN NEXT LINE TO
00321 *INVERT VIDEO
00322 *
3FCE CC 2020 00323 LDD #$2020 CLEAR TO END..
3FD1 ED 81 00324 B9 STD ,X++
3FD3 8C 0600 00325 CMPX #$600 ..OF LAST LINE..
3FD6 25 F9 00326 BLO B9 ..UNTIL DONE
00327 *
00328 *CHANGE $20 TO $60
00329 *IN NEXT LINE TO
00330 *INVERT VIDEO
00331 *
3FD8 C1 20 00332 B2 CMPB #$20 SCROLLED?
3FDA 27 03 00333 BEQ CRS YES
3FDC 17 FE35 00334 LBSR TIMER NO, WAIT ONE BIT
3FDF 86 8F 00335 CRS LDA #$8F CURSOR
3FE1 9E 88 00336 LDX <$88 CURSOR POSITION
3FE3 A7 00 00337 STA 0,X
3FE5 35 96 00338 PULS A,B,X,PC DONE
3DD0 00339 END START
00000 TOTAL ERRORS

```

```

B1 3F89 L11 3F00 LX1 3E00
B2 3FD8 L12 3F01 MSG1 3DF6
B3 3FB2 L13 3F18 NOBRK 3E13
B4 3F9B L14 3F38 OUTCNT 3E1D
B5 3F8F L15 3F31 PARITY 3E1E
B6 3FAE L16 3F3E PIAIN FF22
B7 3FAC L3 3E8F PIAOUT FF20
B8 3FBD L4 3F0E POLCAT 3E91
B9 3FD1 L5 3EC1 POLL 3E02
BITCNT 3E5F L6 3F19 RECV 3E60
BRK 3E0E L7 3F1B SENDER 3E20
CHROUT 3F75 L8 3F03 SENT 3E5D
CLEAR 3DDE L9 3F0C SKIPB 3E41
CNTL 3F57 LNGTIM 3E0C SKIPR 3E2B
CRS 3FDF LOOP1 3DE9 SKIPX 3F6A
DONE 3E8E LOOPA 3E38 START 3DD0
DUPLEX 3E1F LOOPB 3E6D TIMER 3E14
EXEC 3F60 LP1 3F0D TIMERX 3E17
L1 3E98 LP2 3EEF WRDIN 3E5E
L10 3EF5 LX 3EA5 WRDOUT 3E1C

```




TOM MIX SOFTWARE

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32K Mach. Lang.
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Approaches the excitement and challenges of any Video Arcade. The hazards of CU*BER are many. Help CU*BER change the colors on the pyramid while avoiding many of the dangers always present. Vipers, the Nurd, the Dork, bonus points all add up to another exciting release from Tom Mix Software.



Arcade Action. Method of play you are the Grabber. The object is to grab the 8 treasures and store them in the center boxes. You start with 3 Grabbers and get extra ones at 20,000 points. Watch out for the googlies! Super high resolution graphics.

16K Machine Language
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AIR TRAFFIC CONTROLLER

32K Ext. Basic
\$28.95 TAPE
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Air Traffic Controller is a computer model of an air traffic control situation in which Remotely Piloted Vehicles (RPV's) are operated by the controller in landing on and taking off from designated runways.



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Devil Assault is a multi-level multi-screen game in which bird-like creatures, robots and the devil himself assault your home base which you must defend.

BUZZARD BAIT

By RUGBY CIRCLE
16K Machine Language
\$27.95 Tape \$30.95 Disk

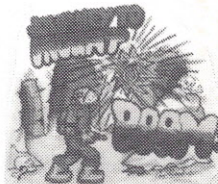
We've done it again! You thought the King was great? wait 'till you see this!! Outstanding high resolution graphics, tremendous sound make this "Joust" type game a must for your software collection. As you fly from cloud to cloud you will enjoy sky high excitement dealing with the challenges presented to you by this newest release by Tom Mix Software.



JOURNEY TO MT. DOOM

32K Mach. Lang.
\$27.95 DISK ONLY

The Necromancer is about to wage war on earth. He needs his lost gold ring to acquire the power to do so. You must find the ring, take it to Mt. Doom and destroy it in the flames from which it came, thus eliminating the Necromancer's evil powers.



"THE FROG"

ARCADE ACTION

This one will give you hours of exciting play... Cross the busy highway to the safety of the median and rest awhile before you set out across the swollen river teaming with hidden hazards. Outstanding sound and graphics.



16K MACHINE LANGUAGE
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Climb vines, avoid obstacles & creatures to save your father from Luigi.

32K CASS \$28.95
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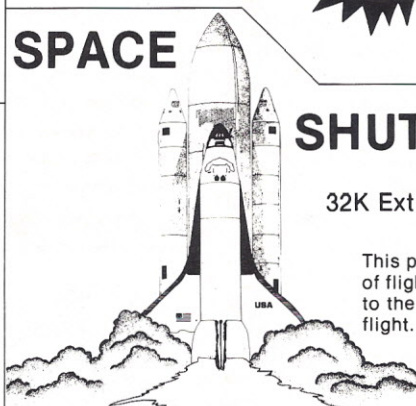
SPACE

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This program gives you the real feeling of flight. Full instrumentation complete to the max. Actual simulation of space flight. 32K Extended Basic



16K MACHINE LANGUAGE
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"TRAPFALL"

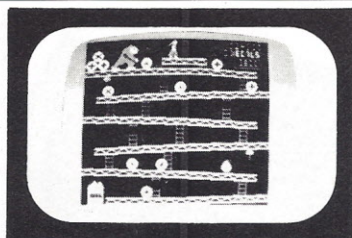
By KEN KALISH

ARCADE ACTION

The "Pitfalls" in this game are many. Hidden treasures, jump over the pits, swing on the vine, watch out for alligators, beware of the scorpion. Another game for the Color Computer with the same high resolution graphics as "The King."

THE KING

32K Machine Language
\$26.95 TAPE
\$29.95 DISK



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Videotext Save

Scotchtape and this program can help you print out that great info you found on CompuServe.

by Steven Wegert

VIDEOTEX (THE RADIO Shack telecommunication software package available in a ROMpak) lets you talk with other computers via the telephone and a modem. You can connect with a local bulletin board system to check out the most recent hints, tips and other assorted goodies on its boards, or take advantage of the free connect time that is part of the Videotex package to go on-line with the CompuServe and Dow Jones information services. However you apply Videotex, its one major shortcoming will soon become apparent.

Videotex has a buffer size commensurate with the amount of usable RAM in your Color Computer. The data sent by the host computer scrolls off your screen and into this buffer to give you the option of later, "off-line" review. But what if you wish to save the information in a more permanent form — say, to tape or as a printout? Radio Shack contends that Videotex does not currently support a dump to tape or printer option. I disagree. All you need is a piece of scotch tape and Program Listing 1. The minimum system configuration required is a 16K Color Computer with Extended Basic. A printer is optional for this application.

Scotch Tape

You must first devise a method to enter and exit Videotex at will. The built-in automatic start feature of the ROMpak works against us here, so eliminate it! Hold the ROMpak cartridge with the

label facing forward and the arrow pointing towards the ceiling. Gently slide the cover back, exposing the connector. You should see some similarity between the photo and what you are holding in your hands. It is not necessary to disassemble the ROMpak as I have done for the photograph; I did so only for clarity.

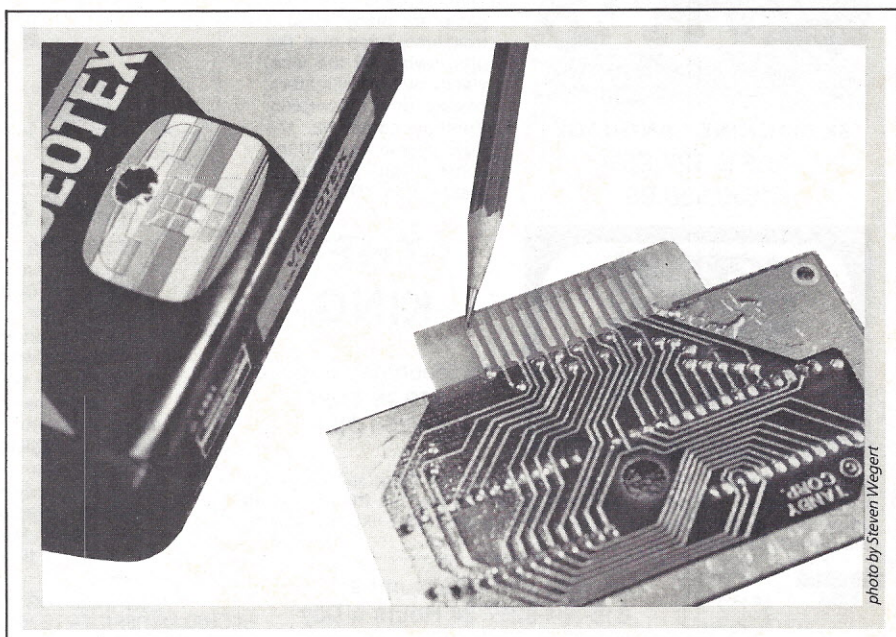
Look carefully. There are contacts on both upper and lower sides of the card. These are separate, individual contacts and are numbered alternately, upper — lower for reference. Radio Shack does not use pins 1 to 6 in their ROMpak, so the contacts are not brought out to the connector. Pins 7 and 8 will appear to be the first pins from the left.

This method of disabling the automatic start feature should work with other ROMpaks as well. However, when mod-

ifying non-Shack cartridges, be certain that pin 8 is the pin you are referencing.

Cover the first contact (from the left, indicated by the pencil tip in the photo) with a piece of ordinary scotch tape. That's it! The automatic execute feature is now disabled and an exit from Videotex to Basic is as easy as pressing the Reset button.

Turn your computer off. Never plug or unplug anything to or from the computer's port with the power on! Serious damage to either the computer or ROMpak can occur! Insert the modified Videotex pak and turn your computer on. You should see the normal Color Computer power-on logo. If not, shut the computer off, remove the ROMpak, and check the placement of the scotch tape. It should cover only the one pin.



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Saving Info

Once you have the logo message on screen, instruct the computer to transfer control to the machine code program in memory (your ROMpak) by typing: EXEC &HC000, or for decimal fans: EXEC 49152. Then quickly press and release the Enter key. You should be greeted with the familiar Videotex logo. If, however, you're faced with a blank screen, don't panic. The keyboard scan routine in Color Basic just sensed more than one keystroke and you're in the Advanced Storage Mode (refer to your Videotex documentation for more details on this feature). Press the Break key and you'll be on your way as usual.

After you have completed your communication session and you are off-line,

press the Reset button. Bingo, you're back to Basic, but your buffer is still intact, hidden deep within RAM. Save memory to tape by typing: CSAVEM "filename",1536,16383,1536 and Enter. (Substitute 32767 for the 16383 end address with 32K computers). Play it safe and make more than one copy. At this point feel free to turn off the computer and remove the ROMpak. Your information is safely saved on tape.

When you wish to review or print out your information, clear all possible memory by typing: POKE 25,6:NEW and Enter. Load your information back into the computer with the CLOADM command but do not EXEC. At the OK prompt enter Program Listing 1 and type RUN.

The program is self prompting. At the

tone, press C to continue paging, P to send the current page to the printer (make certain the printer is ready to print) or E to exit.

The Program

Vidsav/cc is quite elementary in theory as well as in operation. By executing an effective PCLEAR 0 command (POKE 25,6:NEW), the memory reserved for graphics when you turn your computer on is released, letting you place the code in the first available address of user RAM. This is important, as you wish to overwrite as little of your buffer as possible.

The For/Next loop in Line 80 establishes the boundaries of video memory. By PEEKing into the area of RAM that Videotex uses for its buffer, and POKEing those values into the video memory, you will reconstruct your information, character by character, one screen at a time.

Starting at Line 205, through similar gyrations, the video memory is PEEKed and that value is sent to the printer to create a printout of the current page being viewed.

The Listing is freely commented for convenience. Modify it to your heart's content, but keep in mind that the longer the code, the greater must be the value of Y in Line 70.

There are several areas in Vidsav/cc that could be enhanced. For example, a page dump to cassette or a backwards scroll through the buffer could be added. I chose to keep the program short to avoid overwriting the buffer. The solution would be to write the program in assembly language and place it out of harm's way. I chose Basic for its simplicity, not practicality.

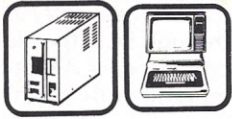
Since this is a quick and dirty fix to a much-complained-about problem, there are some rough spots in the program that warrant explanation. Vidsav/cc is in Basic and may overwrite a portion of memory saved when it is CLOADED. This can be minimized by eliminating all unnecessary spaces and renumbering the program with increments of 1. Also, the program will continue to display memory even after your saved information has long since passed by. This will continue until the E option is chosen.

Vidsav/cc can be downloaded from the Color Computer Special Interest Group (CCSIG) Access database on CompuServe. Once in the XA0 database, type DOW VIDSAB/CC(71735,230).

I would be most happy to respond to questions that include a self addressed, stamped envelope. For a quicker response I may be contacted through EMAIL or on the CCSIG. ■ ■ ■

Program Listing 1. VIDSAB/CC

```
1 'VIDSAV.BAS 05/15/83 VER 1.1
3 ' by Steve Wegert
10 'BEFORE loading this program
20 'execute the mandatory
30 'PCLEAR0 (i.e. POKE25,6:NEW)
40 'or portions of your saved
50 'data may be written over.
70 CLS:Y=1887 'Start of Buffer
75 REM**** SET VIDEO BOUNDARIES
80 FOR X=1024 TO 1503
85 REM**** PUT BUFFER ON SCREEN
90 POKE X, PEEK(Y)
100 POKE X+1,191
110 Y=Y+1
130 NEXT X
140 PRINT@480,"<C> continue <P>
print <E> exit";
150 SOUND 200,2 :SOUND 200,2 :SO
UND 200,2 '**** AUDIBLE PROMPT
160 A$=INKEY$: IF A$="" THEN160
170 IF A$="C" THEN CLS :GOTO 80
180 IF A$="P" THEN GOSUB 205
190 IF A$="E" THEN CLS :END
200 GOTO 140
205 REM***** PRINT ROUTINE
210 FOR S=1024 TO 1503 STEP 32 :
FOR Q=0 TO 31
220 P=PEEK(S+Q) AND 127: IF P>95
THEN P=P-64 ELSE IF P<32 THEN P
=46
230 PRINT#-2,CHR$(P); :NEXT Q :P
RINT#-2 :NEXT S
240 RETURN
```

16K Disk Extended Color Basic

Disk Secrets

Part II of a primer on disks.

by William Barden, Jr.

Last month Bill presented Part I of this primer on disks and disk operating systems. We take up where that article left off, with the File Allocation Table.

SECTOR 1 OF THE directory track is reserved for a File Allocation Table. In the Models I/III/IV, this is called a GAT or Granule Allocation Table. What is a *granule* — one of those subatomic particles like a quark or Charm?

Suppose you're a systems programmer working at MicroSoft writing Disk Operating Systems. How do you "dynamically" allocate disk space? It's logical to divide the disk up into $35 \times 18 = 630$ sectors and allocate them one sector at a time as required. (It's not very convenient to work with segments smaller than 256-byte sectors.) However, 256 bytes is only about eight 32-character lines of text, and that might not be an efficient size. On the other hand, one track on the disk holds 4608 bytes, and that might be too large a chunk, allowing only 34 files on a single disk.

The arbitrary size chosen for files is nine sectors, and this is designated as one granule. This allows for 68 files on a disk, each file capable of holding 2304 bytes in a granule, or 72 32-character lines. In addition, granules can be strung together to make up larger files.

The File Allocation Table takes up the first 68 bytes of sector 2 on the directory track, and appears as shown in Figure 1. The first byte is the code for granule 0 (track 0, sectors 1 through 9), the next byte is the code for granule 1 (track 0, sectors 10–18), and so forth.

If a granule code is a binary \$FF, then that granule is available. If the code is not



photo by Charley Freiberg

\$FF, then the granule is currently occupied by a disk file.

Remember the directory entry? One of the bytes in the entry pointed to the location of the first granule in the file. The file

is found by the Disk Operating System software searching the directory for a given file name. When the name is found, the location of the first granule is in the directory entry. The DOS software then

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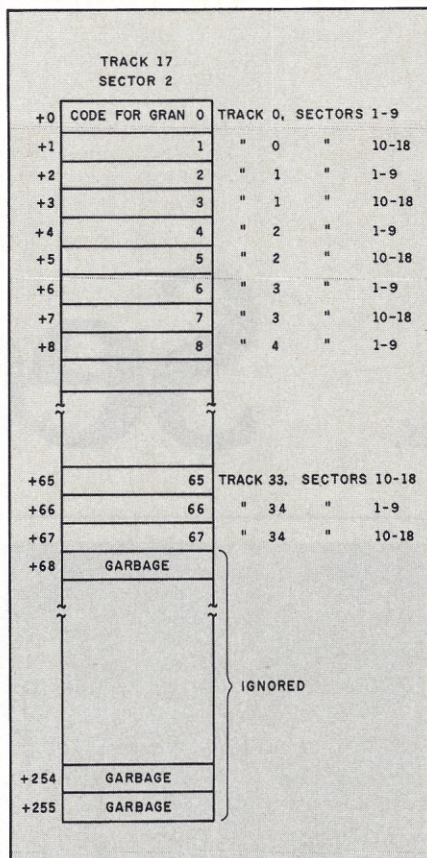


Figure 1. File Allocation Table

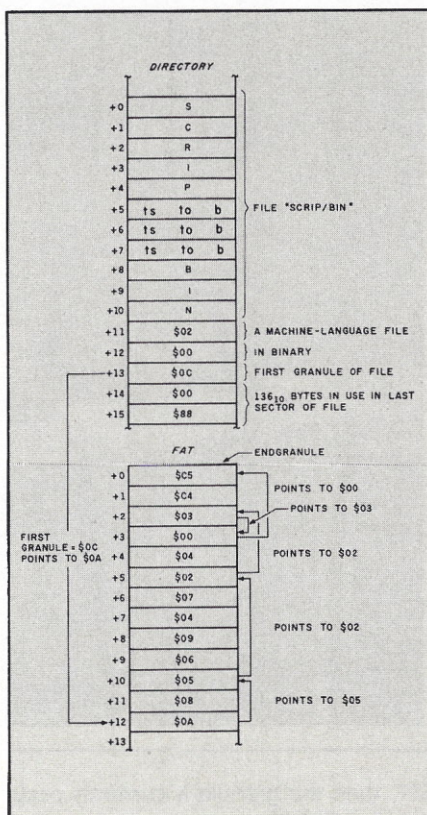


Figure 2. Chained File

looks at the File Allocation Table entry. If it is a value of \$C0 through \$C9, the file is only one granule long. If the File Allocation Table (FAT) entry is other than \$C0 through \$C9, however, the FAT entry points to the next granule of the file. The corresponding FAT entry for the next granule may be \$C0 through \$C9, indicating the last sector of the file, or may point to still another granule. How many granules can be chained together in this fashion? Any number up to the limits of the disk space. Figure 2 shows a typical chained file.

When files are deleted from a disk, the first byte of the directory entry is set to 0, and all FAT entries connected with that file are set to \$FF, indicating that they are available. When files are added to the disk, the DOS software may link together granules that are spread all over the disk, rather than making them one contiguous area. (An interesting point: recopying files to a clean disk may speed up access time, because the new files will be in adjacent sectors — the disk does take some time to step across tracks and find sectors.)

To clean up a couple of loose ends: the format of the FAT entry for the last granule is shown in Figure 3. The lower six bits indicate how many sectors of the granule are actually part of the disk file. In the minimum case, only the first sector of the granule would be used for the file. Bytes 14 — 15 in the directory entry gives the number of bytes in use in the last sector of the file. The DOS software, therefore, knows exactly how many bytes are in the file, even though a portion of the granule may be unused.

Using DSKIS

All of the earlier discussion gives us enough background so we can discuss the Basic DSKIS command. This command lets us read any sector on the disk, setting two strings to the 256 bytes of the sector, as shown in Figure 4.

The format for DSKIS is: DSKIS disk drive number, track number, sector number, string1, string2.

A typical read of the first directory sector from disk drive 0 using DSKIS would be: 100 DSKIS 0,17,3,A\$,B\$. In this case, string A\$ is set equal to the first 128 bytes of sector 3, track 17 and string B\$ is set equal to the last 128 bytes of sector 3, track 17. Why two strings? The 256 bytes in a sector are too long for a single string.

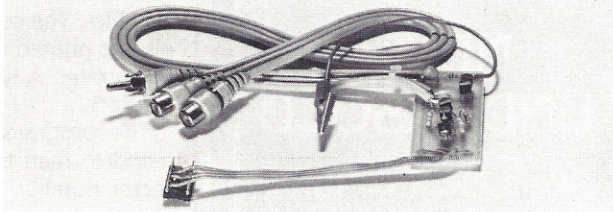
After the DSKIS operation the strings will probably not be printable. The strings will be made up of both printable ASCII characters and non-printable char-

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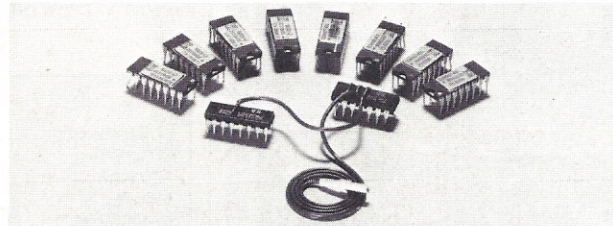
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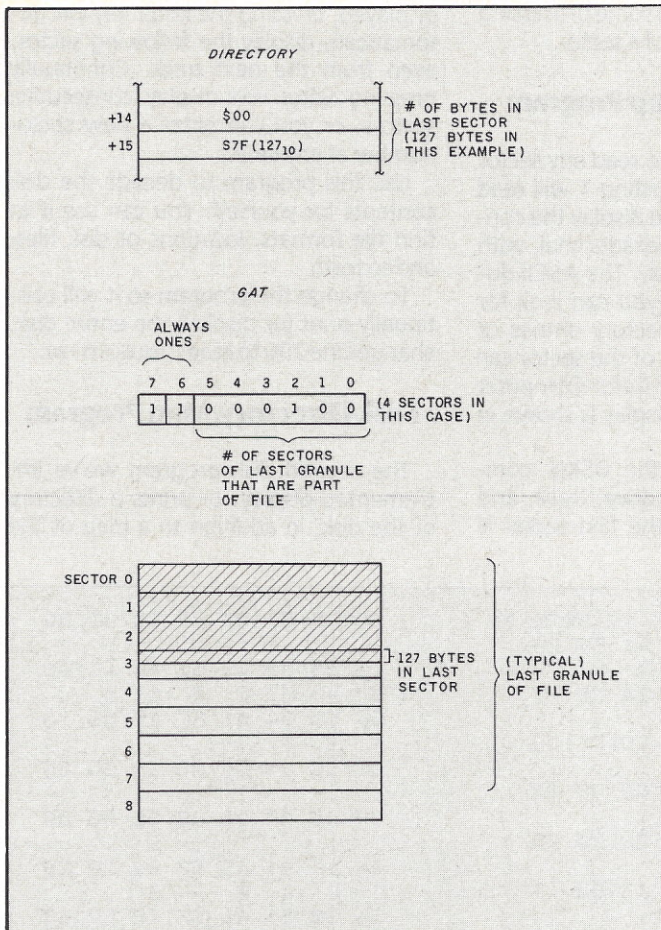


Figure 3. Last Granule FAT Format and Number of Bytes in Last Sector.

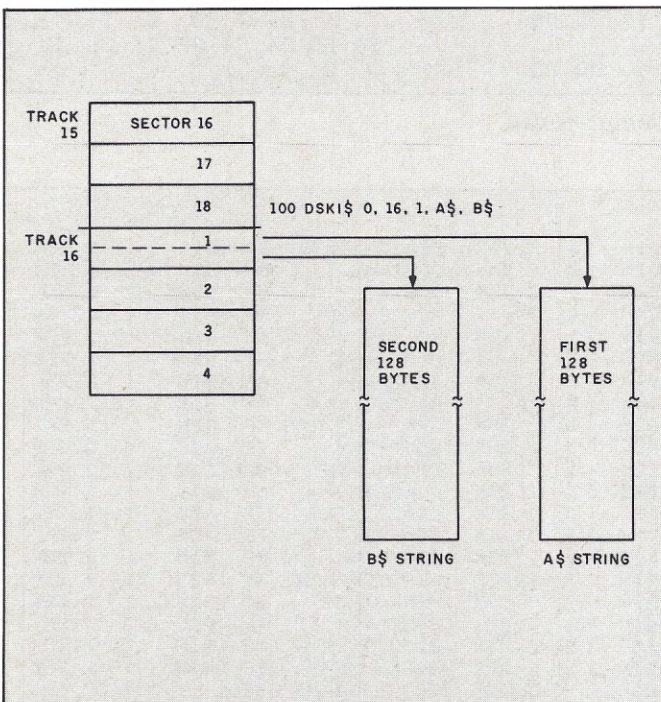
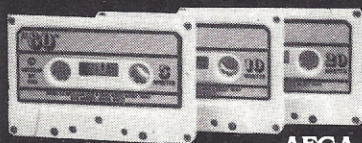


Figure 4. DSK1\$ Operation

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acters. You'll have to do some processing to display the contents of a sector.

Disk Sector Dump Program

We've made it easy to read any sector on the disk. Program Listing 1 will read any disk sector and then display the contents of the sector in hexadecimal, with an optional ASCII display. The ASCII display is handy because you can look for text data to locate directory entries or text files. The contents of the sector can also be printed on your Color Computer line printer. A typical display is shown in Figure 5.

The program uses the DSKI\$ command to read a given drive, track, and sector number. After the first sector is

displayed, pressing the Enter key will automatically display the following sector, even from the next track. Continually pressing Enter will display consecutive sectors, or you can enter a new sector number at any time.

Use this program to decode the disk contents for yourself. You can use it to find file formats, locations of disk files, and so forth.

To change the program so it will continually print (or display) the entire disk, change Line 290 to read: 290 GOTO 190.

Disk Directory/Map Program

The second disk program we've implemented displays or prints a directory of the disk, in addition to a map of the

DRV #: 0	TRK #: 17	SCTR #: 4	00	00	00	00	00	00	00
44	49	53	50	4C	41	59	20		
D	I	S	P	L	A	Y			
54	58	54	01	FF	1A	00	F3		
T	X	T	.	.	.	.	.		
00	00	00	00	00	00	00	00		
00	00	00	00	00	00	00	00		
45	58	53	51	52	20	20	20		
E	X	S	Q	R					
54	58	54	01	FF	1B	00	49		
T	X	T	.	.	.	.	I		
00	00	00	00	00	00	00	00		
00	00	00	00	00	00	00	00		
42	4C	4B	57	48	54	20	20		
B	L	K	W	H	T				
54	58	54	01	FF	18	00	D9		
T	X	T	.	.	.	.	.		
00	00	00	00	00	00	00	00		
00	00	00	00	00	00	00	00		
54	4F	57	45	52	53	20	20		
T	O	W	E	R	S				
54	58	54	01	FF	2B	00	63		
T	X	T	.	.	.	.	c		
00	00	00	00	00	00	00	00		
00	00	00	00	00	00	00	00		
54	45	58	54	4F	55	54	20		
T	E	X	T	O	U	T			
54	58	54	01	FF	16	00	3A		
T	X	T	.	.	.	.	:		

Figure 5. Disk Sector Dump Display

ED/BAS	BP	BIN	1	2.25K	FIG20719/TXT	BD	BIN	1	2.25K
ED%/BIN	MP	BIN	2	4.5K	DOS/BAS	BP	BIN	2	4.5K
AS/BAS	BP	BIN	1	2.25K	DOS/BIN	MP	BIN	2	4.5K
AS%/BIN	MP	BIN	4	9K	SCRIP/BIN	MP	BIN	6	13.5K
DCBUG/BIN	MP	BIN	1	2.25K	XF/BAS	BP	BIN	1	2.25K
XFER/BAS	BP	BIN	1	2.25K	LIST/BAS	BP	BIN	1	2.25K
FILELIST/BAS	BP	BIN	1	2.25K	AXS/BAS	BP	BIN	1	2.25K
HLP%/	TE	ASC	4	9K	BAUDOT/BIN	MP	BIN	1	2.25K
DISPLAY/TXT	TE	ASC	1	2.25K	GRAPHICS/BAS	BP	BIN	2	4.5K
EXSQR/TXT	TE	ASC	1	2.25K	GETF/TXT	TE	ASC	1	2.25K
BLKWH/TXT	TE	ASC	1	2.25K	PROPAL/TXT	BD	BIN	1	2.25K
EXSCROLL/TXT	TE	ASC	1	2.25K	SCR/BIN	MP	BIN	1	2.25K
TOWERS/TXT	TE	ASC	1	2.25K	CRAIG1/TXT	TE	ASC	1	2.25K
TEXTOUT/TXT	TE	ASC	1	2.25K	CRAIG2/TXT	TE	ASC	1	2.25K
DRAWLINE/TXT	TE	ASC	1	2.25K	PRO/BIN	MP	BIN	1	2.25K
ASP/BAS	BP	BIN	1	2.25K	HERTZCV/BIN	MP	BIN	1	2.25K
SVNB9/BAS	BP	BIN	1	2.25K	HSPRO/BAS	BP	BIN	1	2.25K
GENCHLP/BAS	BP	BIN	2	4.5K	BAUDOT2/TXT	TE	ASC	2	4.5K
BAUDOT1/TXT	TE	ASC	3	6.75K	BAUDOT2/BIN	MP	BIN	1	2.25K
EIGHTBY9/BAS	BP	BIN	1	2.25K	BIGNUM/BAS	BP	BIN	1	2.25K
PROPOR/BAS	BP	BIN	1	2.25K	TOTAL GRANS USED:	61	OUT OF	68	
BASPR2/BAS	BP	BIN	1	2.25K	TOTAL K USED:	137.25	OUT OF	153	

Figure 6. Disk Directory Display

disk granules (see Listing 2). The program also tells you how large the files are in K segments (1024 bytes). (I find K easier to relate to than those blasted granules — I always have to multiply by 2,304 in the granule's case.)

The first column of the display (see Figure 6) is the program name and extension. The next is the type of file (BP=Basic program, MP=machine language program, TE=text file, BD=Basic data). The next is the ASCII/binary status of the file. The next is the total number of granules in the file. The last column is the total number of bytes in the file.

At the end of the directory listing the total number of granules and bytes from the directory is printed. I've found that this figure does not always agree with the FREE() command figure. In at least one case, laboriously comparing directory entries with the FAT, I've found granules allocated but with no corresponding directory entry. Operator error? DOS error? You figure it out and call me collect.

One note about the number of granules and amount of total bytes: it is based on the actual number of granules allocated and does not account for any space within the granule that is unused. Even though you may see a FREE() figure of 0 granules, you may have additional room in existing files to add other data. In the average case, you'll have about another 1100 bytes.

At the end of the directory listing, a prompt asks you if you're interested in a disk map. If you are, hit any key and the map shown in Figure 7 will be displayed (not printed). The map indicates an unused granule by a filled bullet and a used granule by an empty bullet. The directory track is not shown.

Today DSKI\$, Tomorrow DSK0\$

The two programs above show what can be done with DSKI\$. It's a far cry

from the Model I days; however, we haven't even touched on DSK0\$, the corresponding command to write sectors, or on machine language disk I/O through a ROM subroutine called DSKCON. Here are some of the things that are possible without too much trouble by using DSK0\$ and DSKCON:

- Password protected files
- Preallocating contiguous areas of disk for large, rapidly-accessed user files
- Disk clean-up programs to rewrite files
- Purge programs to rapidly purge a disk of unwanted files
- Append programs to append two Basic or other files
- Sorted (alphabetized) directories
- "Super" disk directories from a number of disks
- High-speed disk I/O
- Packing data

The list goes on and on. If you would like to see more in this vein, drop me a note, EMAIL me on CompuServe 76703, 347, or leave me a message on the CompuServe Color Computer special interest group (GO PCS-126). 'Til I hear from you, happy disk programming! ■ ■ ■

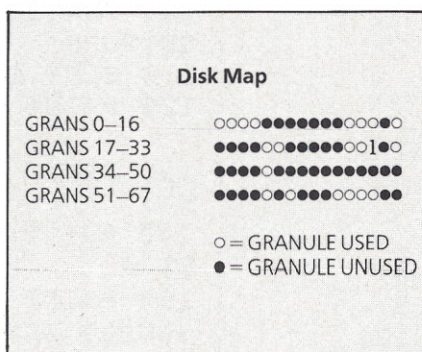


Figure 7. Disk Directory Map

Program Listing 1. Disk Sector Dump

```

90 CLEAR3000
100 'DISK DIRECTORY PROGRAM. MAP
  S DISK AND LISTS DIRECTORY
110 CLS: TN=0
120 PRINT @5,"DISK DIRECTORY PRO
  GRAM"
130 PRINT @32,"PRINTER OUTPUT? E
  NTER Y OR N";: INPUT P$
140 DSKI$ 0,17,2,G1$,G2$
150 FOR S=3 TO 11
160 DSKI$ 0,17,S,A$,B$
170 GOSUB 370

```

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```

180 A$=B$: GOSUB 370
190 NEXT S
200 PRINT "TOTAL GRANS USED: ";TN
; "OUT OF 68"
210 IF P$="Y" THEN PRINT#-2,"TOT
AL GRANS USED: ";TN;"OUT OF 68"
220 PRINT "TOTAL K USED: ";TN*.25
*9;"OUT OF 153"
230 IF P$="Y" THEN PRINT#-2,"TOT
AL K USED: ";TN*.25*9;"OUT OF 153
"
240 PRINT "HIT ANY KEY FOR MAP";
250 A$=INKEY$: IF A$="" THEN 250
260 CLS:PRINT@ 10,"DISKETTE MAP"
270 PRINT@128,"";
280 FOR I=1 TO 4
290 PRINT"GRANS";(I-1)*17;"-";(I
*17)-1;TAB(14);
300 FOR J=1 TO 17
310 A$=MID$(G1$,(I-1)*17+J,1)
320 IF A$=CHR$(255) THEN PRINT "
."; ELSE PRINT "O";
330 NEXT J
340 PRINT
350 NEXT I
360 GOTO 360
370 'LIST DIRECTORY ENTRIES SUBR
OUTINE
380 FOR J=0 TO 3
390 N$=MID$(A$,(J*32)+1,8)
400 E$=MID$(A$,(J*32)+9,3)
410 T$=MID$(A$,(J*32)+12,1)
420 F$=MID$(A$,(J*32)+13,1)
430 G$=MID$(A$,(J*32)+14,1)
440 U$=MID$(A$,(J*32)+15,2)
450 IF LEFT$(N$,1)=CHR$(0) THEN
600
460 IF LEFT$(N$,1)=CHR$(255) THE
N 600
470 FOR K=1 TO 8
480 IF MID$(N$,K,1)=" " THEN 500
490 NEXT K
500 T=ASC(T$)
510 IF T=0 THEN T$="BP" ELSE IF
T=1 THEN T$="BD"
520 IF T=2 THEN T$="MP" ELSE IF
T=3 THEN T$="TE"

```

```

530 IF ASC(F$)=0 THEN F$="BIN" E
LSE F$="ASC"
540 NG=0:G=ASC(G$)
550 GOSUB 620:NG=NG+1: TN=TN+1:
IF G>=192 THEN 560 ELSE 550
560 PRINT LEFT$(N$,K-1);"/";E$;T
AB(13);T$;TAB(17);F$;TAB(22);NG;
570 IF P$="Y" THEN PRINT#-2,LEFT
$(N$,K-1);"/";E$;TAB(13);T$;TAB(
17);F$;TAB(22);NG;
580 PRINT TAB(25);STR$(NG*.25*9)
;"K"
590 IF P$="Y" THEN PRINT#-2, TAB
(25);STR$(NG*.25*9);"K"
600 NEXT J
610 RETURN
620 G=ASC(MID$(G1$,G+1,1))
630 RETURN

```

Program Listing 2. Disk Directory/Map

```

100 'BASIC PROGRAM TO READ DISK
SECTORS
110 CLS: CLEAR 1000
120 PRINT "DISK SECTOR SEARCHER"
130 PRINT "DRIVE#(0-3)";:INPUT D
N
140 PRINT "PRINTER, Y OR N";:INP
UT P$
150 PRINT "TRACK NUMBER (0-34)";
:INPUT ZZ$
160 IF ZZ$="" THEN 190 ELSE TN=V
AL(ZZ$)
170 PRINT "SECTOR # (1-18)";:INP
UT SN
180 PRINT "ASCII, Y OR N";:INPUT
S$: GOTO 200
190 SN=SN+1: IF SN=19 THEN SN=1:
TN=TN+1: IF TN=35 THEN 120
200 DSKI$ DN,TN,SN,AA$,AB$
210 PRINT "DRV #:";DN;"TRK #:";T
N;"SCTR #:";SN
220 IF P$="Y" THEN PRINT #-2,"DR
V #:";DN;"TRK #:";TN;"SCTR #:";S
N

```



```

230 IF (AA$<>STRING$(128,CHR$(25
5))) OR (AB$<>STRING$(128,CHR$(2
55))) THEN 270
240 PRINT "255 DATA PATTERN"
250 IF P$="Y" THEN PRINT#-2,"255
DATA PATTERN"

```

```

260 GOTO 290
270 GOSUB 300
280 AA$=AB$: GOSUB 300
290 GOTO 150
300 FOR ZJ=1 TO 16
310 ZA$=MID$(AA$,(ZJ-1)*8+1,8)

320 GOSUB 380: PRINT
330 IF P$="Y" THEN PRINT#-2
340 IF S$="N" THEN 360 ELSE GOSU
B 520: PRINT
350 IF P$="Y" THEN PRINT#-2
360 NEXT ZJ
370 RETURN

```

```

380 'SUBROUTINE TO PRINT 8 LOCAT
IONS IN HEX. ZA$=8-BYTE STRING.
390 FOR ZI=1 TO 8
400 ZA=ASC(MID$(ZA$,ZI,1))
410 ZB=INT(ZA/16): ZC=ZA-(ZB*16)

```

```

420 ZD=ZB: GOSUB 480
430 ZD=ZC: GOSUB 480
440 PRINT " ";
450 IF P$="Y" THEN PRINT#-2," ";

```

```

460 NEXT ZI
470 RETURN
480 ZD=ZD+48: IF ZD>57 THEN ZD=Z
D+7
490 PRINT CHR$(ZD);
500 IF P$="Y" THEN PRINT#-2,CHR$
(ZD);
510 RETURN
520 'SUBROUTINE TO PRINT 8 LOCAT
IONS IN ASCII. ZA$=8-BYTE STRING

```

```

530 FOR ZI=1 TO 8
540 ZB$=MID$(ZA$,ZI,1)
550 IF (ZB$>=" ") AND (ZB$<CHR$(
128)) THEN 560 ELSE ZB$="."
560 PRINT ZB$;" ";
570 IF P$="Y" THEN PRINT#-2,ZB$;
" ";
580 NEXT ZI
590 RETURN

```

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- SOFTWARE CONTROL**
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- SOFTWARE CONTROL**
Of interrupts from VIA PIA ACIA and A/D
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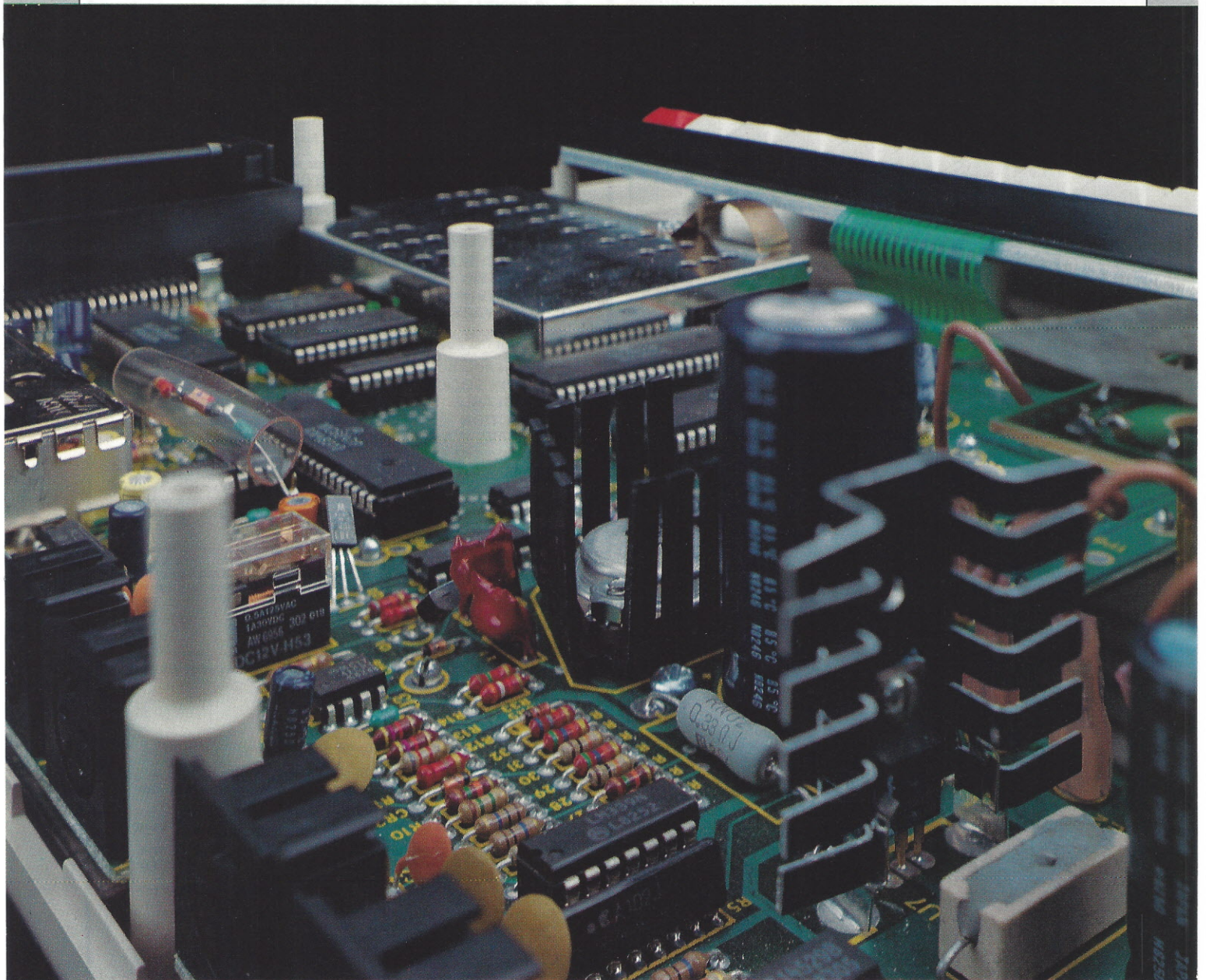
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Explaining



Color Basic ROM

**Part I of an explanation
that should help our readers
who find Jake's disassembly a bit obscure.
Get out your notebooks, get set to concentrate,
and read on . . .**

MICROSOFT'S COLOR BASIC is an outstanding language. While converting TRS-80 Model I/III programs to Color, I discovered some undocumented peculiarities. Investigation of these led to a detailed dissection of the Color Computer operating system. I'll tell you what I found, then I'll discuss how the Basic interpreter works, and finally, how to modify the Basic language. That's right: you can customize your system, and it's really not hard.

How The Interpreter Works

In this simplified description of how the system works, all memory locations and data are given in hexadecimal values.

The legal Basic commands and functions (or keywords) are contained in several lists stored in the ROMs. A separate set of lists stores the execution addresses corresponding to each keyword.

by James A. Sanford

When power is first applied, the system hardware is initialized and several blocks of data are transferred from the ROM to the low (system use only) area of RAM. Some of the information placed there consists of: the number of keywords in a particular list; the address of that list; and the start address of either a vector table (execution addresses) or an execution routine (see Figure 1).

The first block of five bytes, at location 0120, contains the information for Color Basic keywords. The second block contains the information for the Color Basic functions. In Color Basic, the next two blocks contain: 00 — (no more keywords); 4AB4 — (unknown significance); and B277 — (address for routine which generates error messages).

In an Extended Basic system, these blocks will contain data for the Extended Basic keywords and functions and the next two blocks point to the error routine. In a Disk Basic system, these two blocks, beginning at 0133, point to the Disk Basic keywords and functions, with the error information beginning at 013E. In my disk system, this area of memory looks like Figure 1.

Looking at the keyword lists, you will find the ASCII codes for each letter of each keyword with one exception. The last letter of each keyword has 80 added to its ASCII code. This is how the interpreter will recognize the end of a particular keyword. For example RUN is stored as:

```
52 R
55 U
CE N 4E+80
```

When a statement is entered from the keyboard, it goes into a buffer at location

ADDRESS	CONTENTS	COMMENT	ADDRESS	CONTENTS	COMMENT
0120	35	Number of Keywords	0134	13	Number of Keywords
0121	AA66	Address of Keyword List	0135	C17F	Address of Keyword List
0123	AB67	Address of Vector Table or Execution Standard Basic Commands	0137	C220	Address of Vector Table or Execution Disk Basic Commands
0125	14	Number of Keywords	0139	06	Number of Keywords
0126	AB1A	Address of Keyword List	013A	C201	Address of Keyword List
0128	AA29	Address of Vector Table or Execution Standard Basic Functions	013C	C236	Address of Vector Table or Execution Disk Basic Functions
012A	19	Number of Keywords	013E	00	Number of Keywords
012B	8183	Address of Keyword List	013F	4AB4	Address of Keyword List
012D	813C (CE2E)	Address of Vector Table or Execution Extended Basic Commands (with Disk)	0141	B277	Address of Vector Table or Execution No More
012F	0E	Number of Keywords	0143	00	Number of Keywords
0130	821E	Address of Keyword List	0144	B44A	Address of Keyword List
0132	8168 (CE56)	Address of Vector Table or Execution Extended Basic Functions (with Disk)	0146	B277	Address of Vector Table or Execution No More

Figure 1. Initialization Data Blocks

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02DD. When a carriage return is entered, the system looks for a line number at the beginning of the buffer. If one is found, the buffer contents will be tokenized and then placed in the Basic area of RAM. *Tokenization* converts a several byte instruction into one or two bytes, saving memory. If there is no line number, the buffer will be tokenized, and then immediately executed.

To tokenize an instruction, it is compared with the words in the keyword list until a match is found. A counter keeps track of the number of words checked until this match is obtained. This number, logically ORed with 80, will become the token for that keyword. If all keyword lists are checked with no match, the token becomes FF, and the function lists are checked. If the word is a valid function, a second byte of the token will be generated, consisting of the number of

words checked, logically ORed with 80.

If all keyword and function lists are checked with no match, the error routine is called to report a syntax error (SN). Figure 2 is a flowchart of this process.

Once the input is tokenized, execution will depend on whether it is a Basic command, an Extended Basic command, or a Disk Extended Basic command.

In Basic, the value 80 is subtracted from the token. The resulting value is used as an offset from the vector table address to obtain the address for the appropriate ROM routine. (The 6809 microprocessor's extended indirect addressing mode makes this easy). Control will be transferred to the appropriate subroutine.

For example, suppose the word typed in was RUN. This is tokenized as 8E. When executed, 80 is subtracted, resulting in 0E. This is multiplied by two (since ad-

dresses take two bytes) and added to the address of the vector table for Basic commands (AB67), resulting in AB83. The two bytes at AB83 contain the address AE75. The system will now jump to AE75 and begin the process of running the Basic program. See Figure 3 for a flowchart of this.

In Extended or Disk Basic, control goes to a routine in the Disk or Extended Basic ROM which eventually accomplishes the same task. First, some special functions and limits are checked, and then a similar technique is used to find the proper ROM routine.

Knowing how Basic commands are interpreted, it is possible to look at the routines for each Basic command and study what happens in each. Many of the ROM routines have points where they jump to a RAM subroutine. I call these points "intercepts." These exist to allow for expansion of the system. Most of these intercepts contain value 39, which is RTS (return from subroutine), placed there during initialization. Some will contain jump commands to either disk or Extended Basic ROMs. Armed with this informa-

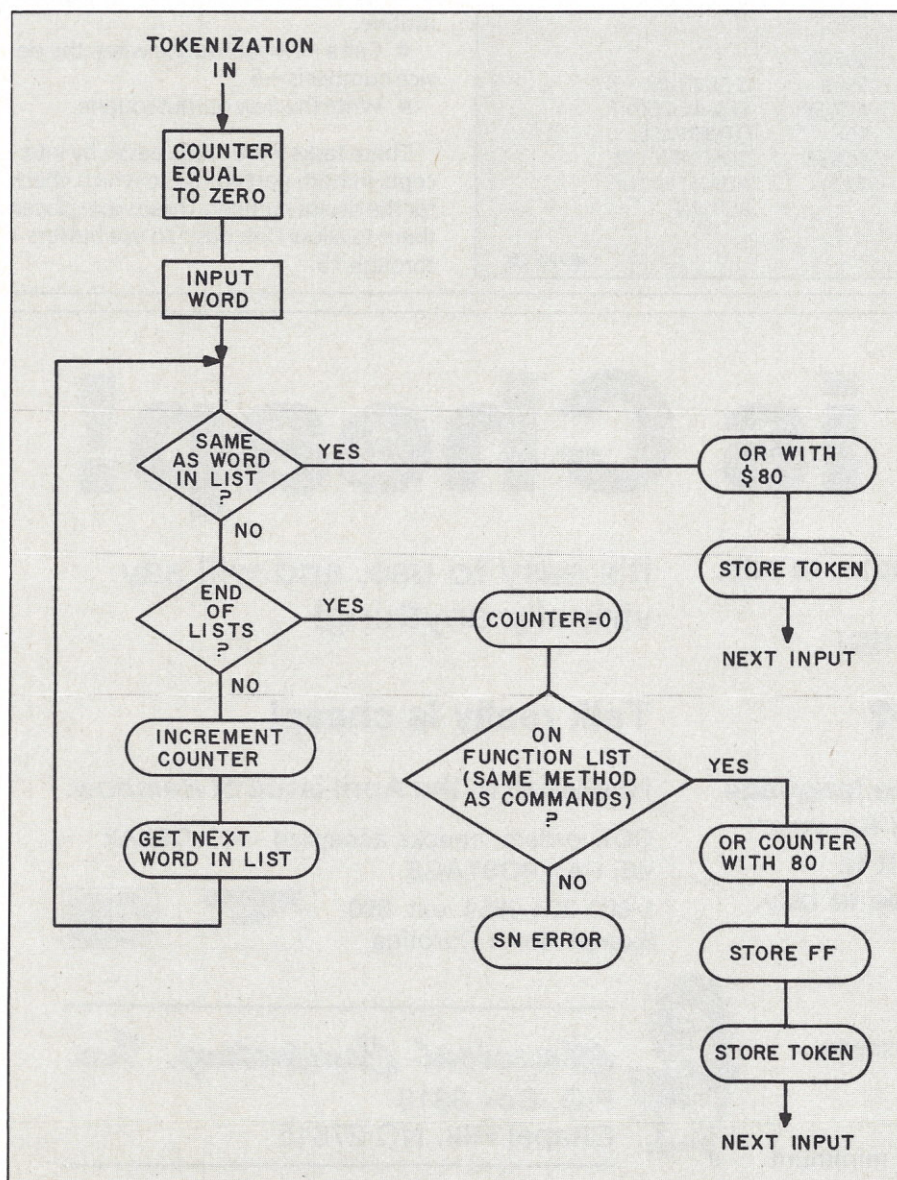


Figure 2. SN Error Routine Flow Chart

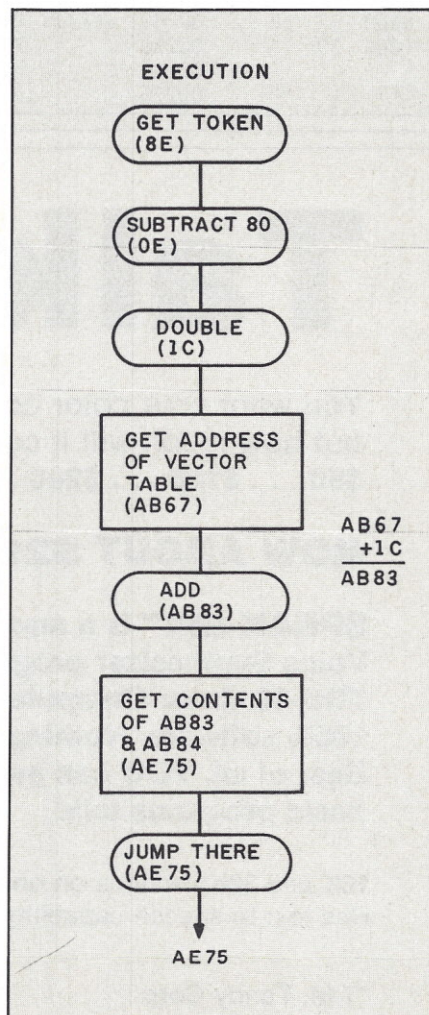


Figure 3. Getting Correct Values

tion, it is possible to study existing commands, modify them, or even create your own. This can lead to a highly customized Basic language.

Modifying Basic Commands

One of my hardware modifications is a parallel printer port. It would be nice if

some easy way to access this were available from Basic without constantly resorting to USR functions. To see if this was possible, I investigated the output routines. The Radio Shack manuals were helpful here. They refer to a routine called CHROUT which takes the character in the A register and outputs it to the device specified by DEVNUM (location

6F). Valid device codes (or numbers) are:

- 2: the serial printer port
- 1: the cassette port
#0: the screen/keyboard
#1 - 15: the disk buffers. Zero is the default if no device is specified

Tracing the Print and Print # routines, I found that, as expected, they then call CHROUT to do the actual output operation.

Tracing through CHROUT I discovered that it checks for a valid device code (if the device is not valid, a device number error is indicated). It also transfers control to the appropriate subroutine which will actually transmit the character to the correct device.

To modify this for the parallel port, I created a new device number: - 5. The steps for making this a valid device number are:

- Intercept the device code validating routine.
- Call a new subroutine when the device number is - 5.
- Write the new output routine.

These tasks were made easier by intercepts in both parts of Basic which check for the device number. These were placed there to allow Disk Basic to use buffers 1 through 15.

Program Listing 1. Routine to Force Acceptance of Device Code - 5

```

                                00100
                                00110
                                00120
                                00130 *ROUTINES TO FORCE ACCEPTANCE OF DEVICE CODE - 5
                                00140
0161                            00150      ORG      $0161
                                00160
0161 7E 0200                    00170      JMP      $0200      INTERCEPT
                                00180
0200                            00190      ORG      $0200
0200 C1 FB                      00200      CMPB    $$FB      IS DEVNUM - 5?
0202 27 05                      00210      BEQ     ACCEPT    YES, ACCEPT IT
0204 D6 6F                      00220      LDB     $6F      OTHERWISE
0206 7E C838                    00230      JMP     $C838    CONTINUE ON
0209 32 62                      00240      ACCEPT LEAS    02,S  ADJUST STACK
020B 39                          00250      RTS      RETURN
                                00260
                                00270

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The device number validation routine was intercepted at location 0161 with a jump to 0200. At 0200, the device number is compared with FB, the two's complement arithmetic representation for -5. If it is -5, the stack pointer is readjusted, and the program returns to the ROM with a valid device code. If the device code is anything else, the program jumps to C838 in the Disk Basic ROM as if nothing had happened.

In a non-disk system, you would use the appropriate Basic or Extended Basic location. This portion of the modified system RAM can be seen in Listing 1.

Next, the actual output handler is intercepted at 0167 with a jump to 0210. Again the device number is checked, and if equal to -5, control goes to a subroutine which will actually transmit the character in A to the parallel port. Upon return from this subroutine, the stack pointer is adjusted, and the program jumps back to Basic, ready to get the next command. If the device number is not -5, the program jumps to CB4A (for a disk system), once again as if nothing unusual had happened. Listing 2 shows an example of this section of memory with the new output routine located at A2BF. This is actually the ROM routine which outputs via the serial port. With the modification, the statements:

10 PRINT #-2, "TEST"
20 PRINT #-5, "TEST"

will accomplish the same thing.

There is one possible pitfall to making this change: make *all* changes to system intercepts either in one Basic program

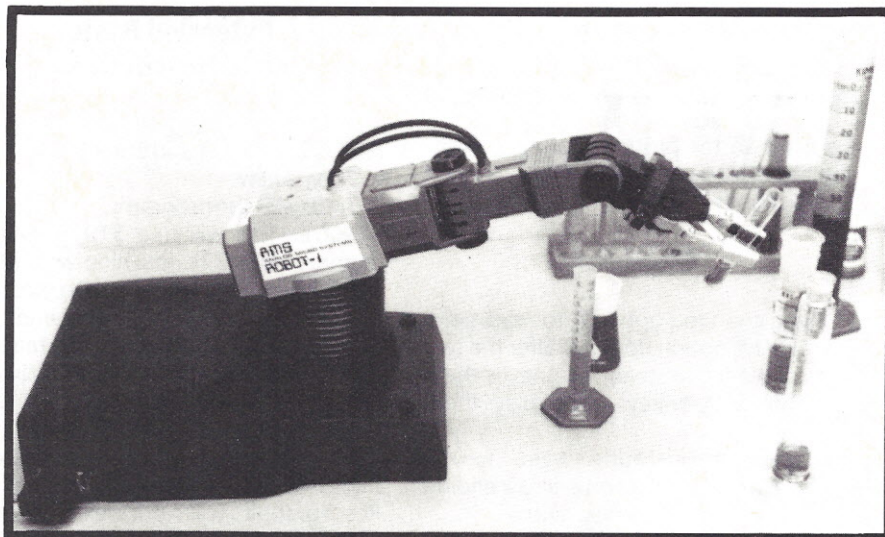
line or one immediate instruction. If an output function is attempted while only some of these changes have been made, a massive crash will result, probably requiring a cold start to recover. ■ ■ ■

Next month: Creating commands, and more!

Program Listing 2. Routine to Use Device Code - 5

		00280			
		00290			
		00300			
		00310			
		00320	*ROUTINE TO USE DEVICE CODE - 5		
		00330			
0167		00340	ORG	\$0167	
		00350			
0167	7E	0210	JMP	\$0210	INTERCEPT
		00370			
0210		00380	ORG	\$0210	
0210	C1	FB	CMPB	#\$FB	IS DEVICE NUMBER - 5?
0212	27	03	BEQ	PARLEL	IF SO, USE IT
0214	7E	CB4A	JMP	\$CB4A	OTHERWISE GO ON TO THE
		00420	*DISK PRINT ROUTINE		
0217	BD	A2BF	PARLEL JSR	\$A2BF	G TO THE SERIAL PORT
		00430			
		00440	*USED FOR ILLUSTRATION		
		00450	*YOU COULD USE YOUR OWN PARALLEL PORT ROUTINE HERE		
021A	32	62	LEAS	O2,S	ADJUST STACK
021C	7E	A2A6	JMP	\$A2A6	CONTINUE (PRINT) ROUTINE
		00480			

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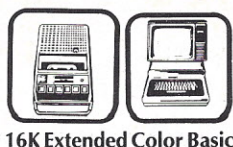
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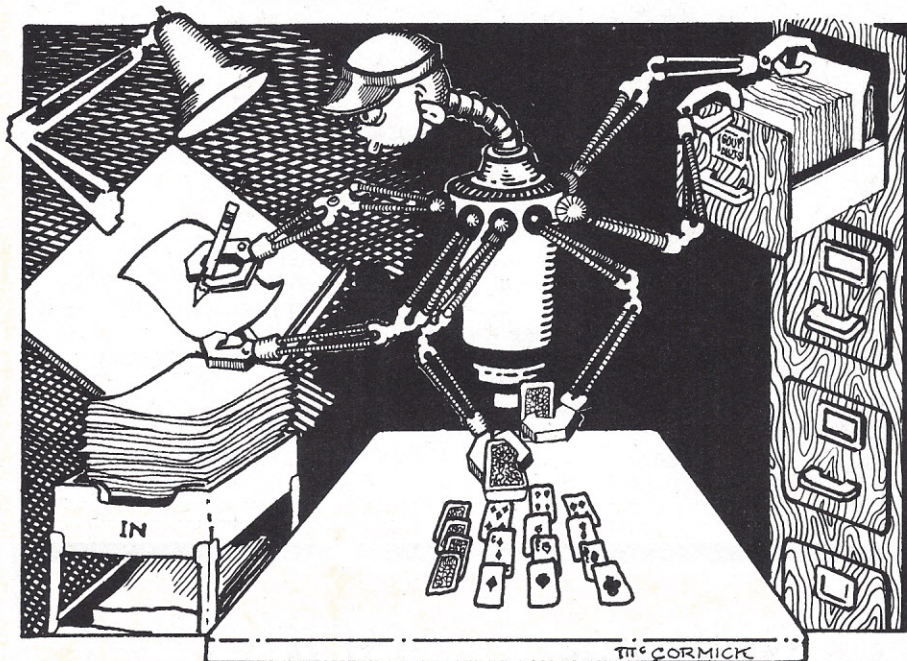
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Modified Basic DBM

Changes to make Detwiler's program even more useful.



16K Extended Color Basic



WHEN I RECEIVED my premier issue of **The Color Computer Magazine**, I keyed in the program listing for "Your Basic DBM," written by Paul Detwiler. I was pleased and impressed by the versatility of the program.

I discovered only one bug — Line 6560, which reads: Input "Your Selection";M. The problem created by this line is that M is used elsewhere in the program to store the maximum number of records the file will hold. Therefore, if you created a file and used option 4 on the menu, M would be overlaid by your selection in Line 6560. Then when you saved the file, the entire file would be saved but the maximum record parameter would be written to the tape as either a 1 or 2. This prevents you from reloading the tape because it generates a subscripting error while loading, because the program uses this parameter to dimension the D\$ array. To correct this problem, simply change M to M1 in Line 6560, and again in Line 6570.

After using the program several times, I realized some additional changes could

be made to the program to make information retrieval easier. Below are some suggestions.

by Charles R. Jefferson

Changes

First I changed option 4 to read Search Records. This option does not alter the records in the file. Instead, it retrieves them based on a key or keys and displays them to the screen.

The first routine I added was 5 — Sort File. This will order the records in ascending order on either one or two fields.

The second routine I added was 7 — Word Search. This routine asks you to enter a word or phrase, and then retrieves all records with that word or phrase. It makes no difference what field the word is on or even if it is in the middle of a group of words. As far as I know, the statement INSTR, which is the heart of this

routine, is supported only by Extended Color Basic. Those of you without Extended Basic should be able to rewrite the routine using MID\$ and a string comparison; however, this would run more slowly and use a bit more memory.

The third routine I added was 8 — Modify Records. This routine works like the Delete routine. You must know the record number to be able to modify it. You will be asked if you know the record number, and if you respond N you will be asked to enter S to scan the file. If you respond Y you will be asked to enter the record number. The routine will then display the first field of data from the record and ask you to type in new data or hit Enter for the next field. Your options then are to type in new data for that field and enter it, or to hit Enter and leave that field unmodified. This process is repeated until all fields are displayed for that record. The program then asks you for the next record number to modify. If you do not want to modify any more records, enter a zero and the menu will appear again.

The fourth routine I added was 9 — Load Another File. This is a one line routine which re-runs the program, clearing all dimension statements and letting you create or load another file.

I have enclosed a complete Program Listing for the changes and additions listed above. These routines add about 1K to the program size; however, it is possible under 16K or 32K Extended Color Basic to offset the 1K addition and gain another ½K of extra memory for program execution and string space.

Extended Basic Load Instructions

1. Before loading the program, type POKE 25,6: POKE 26,1 and Enter.

2. Type NEW.

3. LOAD the program.

NOTE: This will free 31015 bytes of memory on a 32K machine and 14361 bytes on a 16K machine. Do not type PCLEAR 1 because this command only gives you 29479 bytes on a 32K machine and 13095 bytes on a 16K machine. By using the POKES, no high resolution graphics pages are reserved. You can use these POKES in any program that does not use high resolution graphics. Set/Reset graphics will work well.

If you renumber your program using RENUM 1,10,1, you will free about 92 additional bytes of memory. (This renumbers your program by ones).

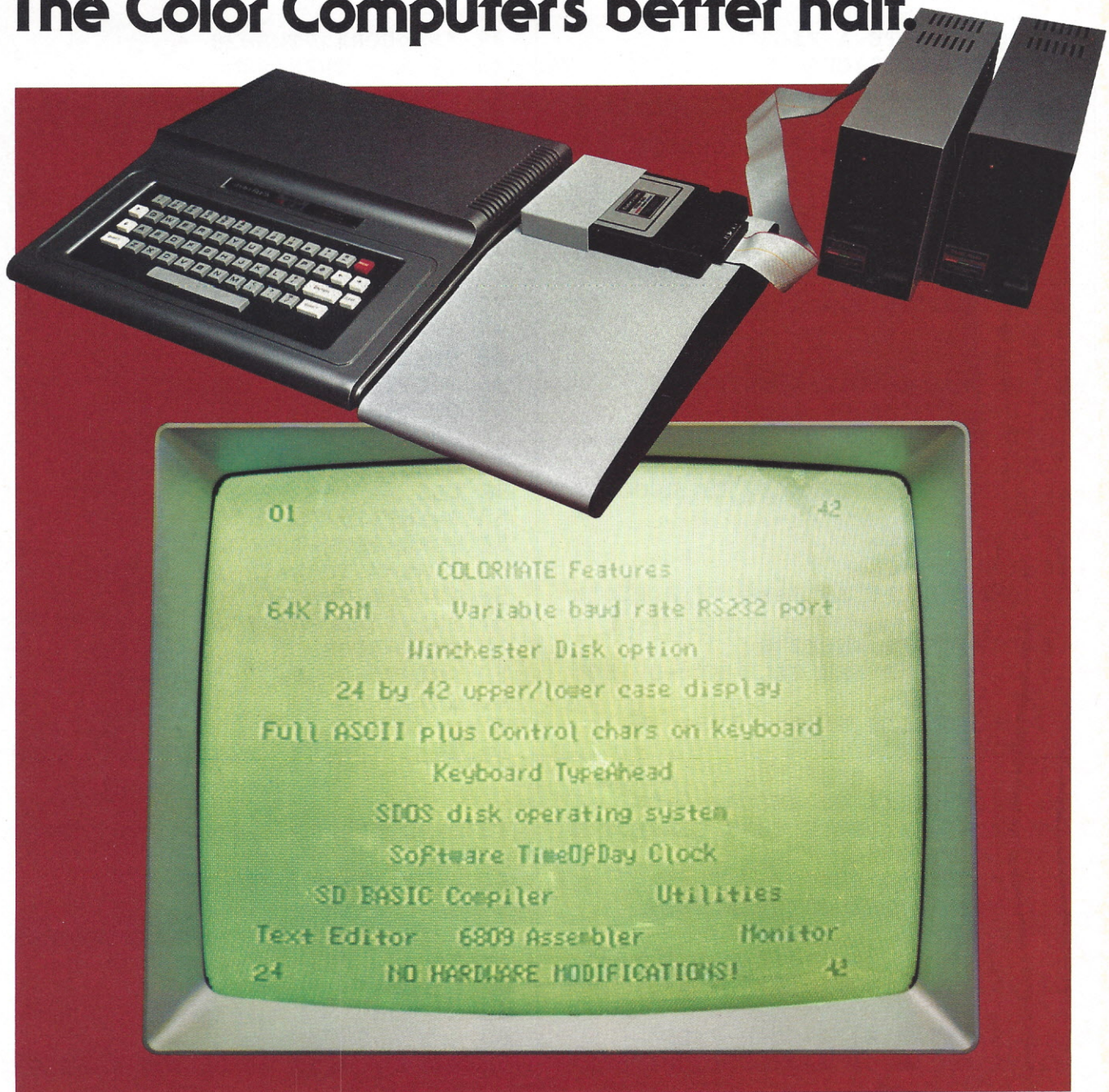
These additions were developed on a 32K machine. If you have a 16K machine, change the clear statement in Line 10 to CLEAR 7500 to be safe.

◆ ◆ ◆

◆ Program

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Color Computer/79

Program Listing. DBM Mods

```
1 CLS: CLEAR 20000
2 CF$="CREATE A FILE"
3 PRINTTAB(10)CF$
4 PRINT:PRINTTAB(10)"SELECT 1 OR
  2"
5 PRINT:PRINTTAB(7)"1-CREATE A N
  EW FILE"
6 PRINT:PRINTTAB(7)"2-LOAD AN OL
  D FILE"
7 PRINT:INPUT"          YOUR SELECTI
  ON";I
8 ONI GOTO10,206
9 GOTO1
10 CLS
11 PRINTTAB(10)CF$:PRINT
12 INPUT"NAME OF FILE";N$
13 INPUT"NUMBER OF FIELDS 10 MAX
  ";N
14 INPUT"WHAT IS MAX# OF RECORDS
  ";M
15 DIMD$(M,N)
16 FOR Z=1TON
17 PRINT"WHAT IS NAME OF FIELD"Z

18 INPUTF$(Z):NEXT Z
19 CLS:PRINT"THE FILE SET-UP FOL
  LOWS":PRINT
20 PRINT"FILE NAME - "N$
21 FOR X=1TON
22 PRINT"FIELD"X"- "F$(X):NEXTX
23 PRINT"MAX# OF RECORDS -"M
24 PRINT:PRINT"IS THIS CORRECT Y
  /N":INPUTI$
25 IFI$="N"THENRUN
26 IFI$="Y"THENGOTO27ELSE19
27 Q=1
28 CLS:PRINTTAB(10)"SELECT 1-9"
29 PRINT:PRINTTAB(8)"1-INPUT DAT
  A"
30 PRINTTAB(8)"2-SCAN FILE"
31 PRINTTAB(8)"3-DELETE RECORDS"

32 PRINTTAB(8)"4-SEARCH RECORDS"

33 PRINTTAB(8)"5-SORT FILE"
34 PRINTTAB(8)"6-SAVE FILE"
35 PRINTTAB(8)"7-WORD SEARCH"
36 PRINTTAB(8)"8-MODIFY A RECORD
  "

37 PRINTTAB(8)"9-LOAD ANOTHER FI
  LE"
38 PRINT:INPUT"          YOUR SELEC
  TION";A
39 IFA<0ORA>9THEN28
40 IF A=9 THEN RUN
41 ONA GOSUB43,52,69,89,156,197,
  214,231
42 GOTO28
43 CLS
44 PRINT:PRINTTAB(10)"RECORD #"Q

45 FORY=1TON
46 PRINT"ENTER "F$(Y):INPUTD$(Q,
  Y)
47 IFD$(Q,Y)="STOP"THEN51
48 NEXTY
49 Q=Q+1:IF Q>M THEN28
50 GOTO44

51 D$(Q,Y)="":GOTO28
52 CLS
53 P=INT(16/(N+2))
54 FORX=1TOQ-1STEPP
55 FORZ=X TO X+(P-1)
56 IFZ>=Q THEN66
57 PRINT"RECORD #"Z
58 FORW=1TON
59 PRINT" "F$(W)"-"D$(Z,W)
60 NEXTW
61 NEXT Z
62 PRINT"PRESS <XX> TO STOP SCAN
  "

63 INPUT"PRESS <ENTER> TO CONTIN
  UE";G$
64 IF G$="XX" THEN 28
65 CLS:NEXTX
66 PRINT:PRINT"*****LAST RECORD
  *****"
67 INPUTA$
68 GOTO28
69 CLS:R=0
70 PRINT:INPUT"TO DELETE A RECOR
  D THE RECORD # MUST BE KNOWN. IS
  THE RECORD # KNOWN? Y/N";G$
71 IFG$="Y"THEN76
72 IFG$="N"THEN PRINT"ENTER <S>
  TO SCAN RECORDS"ELSE69
73 INPUTK$
74 IFK$="S"THEN GOTO52
75 PRINT"REDO"
76 INPUT"WHAT IS THE RECORD #";R

77 IFR>Q-1THEN75
```

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```

78 IFR=0THEN28
79 FORX=R TO Q-2
80 FORV=1TON
81 D$(X,V)=D$((X+1),V)
82 NEXTV
83 NEXTX
84 FORL=1TON
85 D$(X,L)=" "
86 NEXTL

87 Q=Q-1
88 GOTO28
89 K=0
90 GOSUB117
91 RETURN
92 CLS:K=0
93 PRINT"WHAT FIELD WILL YOU SEARCH ON":PRINT
94 FORZ=1TON
95 PRINTTAB(8)Z"-F$(Z)
96 NEXT Z
97 INPUTE
98 IF E<0ORE>N THEN93
99 INPUT"FIELD DATA TO SEARCH  O
N";Q$
100 CLS
101 FORZ=1TO Q-1
102 IFQ$=D$(Z,E)THEN GOSUB107
103 NEXTZ
104 PRINT"***ALL RECORDS FOUND**
*"
105 INPUT"PRESS <ENTER> FOR MENU
";L$
106 RETURN
107 PRINT"RECORD #"Z
108 K=K+1
109 FORW=1TON
110 PRINTF$(W)"-D$(Z,W)
111 NEXTW
112 P=INT(16/(N+2))
113 IFK<P THEN RETURN
114 INPUT"PRESS <ENTER> TO CONTI
NUE";B$
115 K=0:CLS
116 RETURN
117 CLS
118 PRINT:PRINTTAB(10)"SELECT 1-
4"
119 PRINT:PRINTTAB(3)"1-STRING M
ATCH ON 1 FIELD"
120 PRINTTAB(3)"2-STRING MATCH O
N MULTIPLE"
121 PRINTTAB(5)"FIELDS"
122 INPUT"          YOUR SELECTIO
N";M1
123 IFM1<0ORM1>4THEN117
124 ON M1 GOSUB92,126

```

```

125 RETURN
126 CLS:K=0
127 PRINT:PRINT"WHAT FIELDS WILL
YOU SEARCH ON (2 MAX)"
128 FORZ=1TON
129 PRINTTAB(8)Z"-F$(Z)
130 NEXT Z
131 INPUT"FIELDS A,B";U,V
132 PRINT:PRINTTAB(10)"WHICH LOG
IC"

133 PRINT:PRINTTAB(14)"1-AND"
134 PRINTTAB(14)"2-OR"
135 PRINTTAB(14)"3-NOT"
136 INPUT T
137 PRINT"DATA FOR FIELD"U
138 INPUT U$
139 PRINT"DATA FOR FIELD"V
140 INPUT V$

141 IFT=1 THEN144
142 IFT=2 THEN148
143 IFT=3 THEN152ELSE132
144 CLS:FORZ=1TOQ-1
145 IFU$=D$(Z,U)AND V$=D$(Z,V)TH
EN GOSUB107
146 NEXTZ
147 GOTO104
148 CLS:FORZ=1TOQ-1
149 IFU$=D$(Z,U)OR V$=D$(Z,V)THE
N GOSUB107
150 NEXTZ
151 GOTO104
152 CLS:FORZ=1TOQ-1
153 IFU$=D$(Z,U)AND V$=D$(Z,V)TH
EN NEXTZ ELSE GOTO154
154 IF U$=D$(Z,U) OR V$=D$(Z,V)
THEN NEXTZ ELSE GOSUB 107:NEXTZ
155 GOTO 104
156 CLS:PRINTTAB(8)"1-SORT ON ON
E KEY"
157 PRINT:PRINTTAB(8)"2-SORT ON
TWO KEYS"
158 PRINT:PRINTTAB(8)"YOUR SELEC
TION"
159 INPUTS
160 FORX=1TON
161 PRINTX"-F$(X)
162 NEXTX
163 IFS=1 THEN PRINT:PRINT"SELEC
T FIELD":GOTO 166
164 IFS=2 THEN PRINT:PRINT"SELEC
T 2 FIELDS (1,2)":GOTO180
165 GOTO156
166 INPUT K1
167 IF K1<1 OR K1>N GOTO156

```

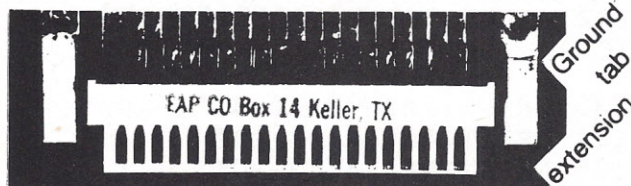
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```

168 S=0
169 FORX=1TOQ-2
170 IF D$(X,K1)<=D$(X+1,K1) THEN
171   177
171 FOR J=1TON
172 S$=D$(X,J)
173 D$(X,J)=D$(X+1,J)
174 D$(X+1,J)=S$
175 NEXT J
176 S=1
177 NEXTX
178 IF S=1 THEN 168
179 RETURN
180 INPUT K1,K2
181 IF K1<1 OR K1>N THEN 156
182 IF K2<1 OR K2>N OR K2=K1 THE
N 156
183 S=0
184 FOR X=1TO Q-2
185 K1$=D$(X,K1)+D$(X,K2)
186 K2$=D$(X+1,K1)+D$(X+1,K2)
187 IF K1$<=K2$ THEN 194

```

```

188 FOR J=1TON
189 S$=D$(X,J)
190 D$(X,J)=D$(X+1,J)
191 D$(X+1,J)=S$
192 NEXT J
193 S=1
194 NEXT X
195 IF S=1 THEN 183
196 RETURN
197 CLS:PRINT@135,"SAVE FILE ON
TAPE":PRINT@294,"READY CASSETTE"
:PRINT@388,"PRESS <ENTER> WHEN R
EADY"

```

```

198 INPUTA$
199 OPEN"O",#-1,N$
200 PRINT#-1,N,M
201 FORX=1TOQ-1
202 FORZ=1TON
203 PRINT#-1,F$(Z),D$(X,Z)
204 NEXTZ:NEXTX
205 CLOSE #-1:RETURN
206 CLS:INPUT"WHAT IS FILE NAME"
;N$
207 CLS:PRINT@136,"LOAD FILES FR
OM TAPE":PRINT@235,"REWIND TAPE"
:PRINT@300,"PRESS PLAY":PRINT@38
8,"PRESS <ENTER> WHEN READY":INP
UTY$
208 OPEN"I",#-1,N$
209 INPUT#-1,N,M:Q=1:DIMD$(M,N)
210 IF EOF(-1) THEN 213

```



```

211 FOR Z=1TON:INPUT#-1,F$(Z),D$(
(Q,Z):NEXTZ
212 Q=Q+1:GOTO210
213 CLOSE#-1:GOTO28
214 CLS:PRINTTAB(4)"WORD/PHARSE
SEARCH"
215 PRINT:PRINT"WORD OR PHRASE T
O SEARCH FOR"
216 INPUTS$:SW=0
217 CLS:K=0
218 FORZ=1TO Q-1
219 FORX=1TON

```

```

220 IF INSTR(D$(Z,X),S$) THEN GO
TO221 ELSE GOTO227
221 SW=1:PRINT"RECORD # "Z:K=K+1
222 FORW=1TON
223 PRINT" "F$(W)"-"D$(Z,W):NEXT
W
224 P=INT(16/(N+2))
225 IFK<P THEN 228
226 INPUT"PRESS <ENTER> TO CONTI
NUE";B$:K=0:CLS
227 NEXT X
228 NEXT Z
229 IF SW=0 THEN PRINT"***NO MAT
CH***" ELSE PRINT"***ALL MATCHES
FOUND***"

```

```

230 INPUT"<ENTER> FOR MENU";S$:R
ETURN
231 CLS:R=0
232 PRINT:INPUT"TO MODIFY A RECO
RD THE RECORD # MUST BE KNOWN.
IS THE RECORD # KNOWN ? Y/N";G$

```

```

233 IF G$="Y" GOTO 236
234 IF G$="N" THEN PRINT"PRESS <
S> TO SCAN FILE"ELSE GOTO 231
235 INPUTK$:IF K$="S" THEN GOTO5
2
236 CLS:PRINT"ENTER A ZERO TO EX
IT"
237 INPUT"WHAT IS THE RECORD #";
R
238 IFR=0 THEN RETURN
239 CLS
240 FORX=1TON
241 PRINTF$(X)"-"D$(R,X)
242 INPUT"ENTER NEW DATA OR PRES
S ENTER FOR NEXT FIELD";Q$
243 IFQ$="" THEN 245
244 D$(R,X)=Q$
245 NEXTX
246 GOTO236

```

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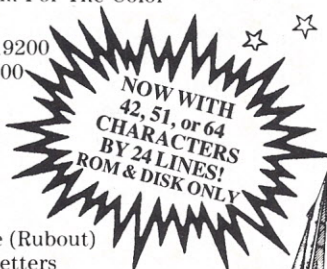
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Color Computing for Kids

If...then...else statements and more!

THIS COLUMN began in the September 1983 issue. That was six months ago, so: IF you've followed all my articles THEN your computer experience = six lessons; ELSE if you missed any articles THEN your experience is < (less than) six lessons; ELSE if you've followed all the articles and have gotten information on your own, THEN your experience is > (greater than) six lessons.

These words and symbols (IF, THEN, ELSE, <, >, =) may be a little awkward when used in a paragraph this way, but they're very meaningful and useful in computer programs.

There are times when a program's variables need to be compared (or tested) so that a different action can be taken for each possibility: IF $A = B$ THEN; IF $A > B$ THEN; IF $A < B$ THEN; IF $A < > B$ THEN...ELSE; IF $A + B > C \times D$ THEN...ELSE; IF $C = > D$ THEN; IF $B < + A$ THEN...

There are many other combinations possible with these statements; we'll use some in programs so you can see them work. The symbols < (less than), > (greater than), and = (equal to) are called *operators*; they help us find the largest, smallest or equal variables in a program. We will use the operators to compare numbers, to compare letters in a program that will alphabetize names (IF $L\$ < R\$$ THEN...) and we'll use the operators to test the INPUT response in a game program.

IF you've been following "Color Computing for Kids," THEN you know to expect at least one fun program (that uses our lesson along with the month's holiday or theme), ELSE you would be very disappointed. In honor of St. Patrick's Day, I've written "Shamrock's Crown," a game that takes skill along with a little luck of the Irish. Before we get to that we have a few things to learn.

Just How Smart Is A Computer?

Computers do only what we program them to do; if we make a mistake, they'll make mistakes or give us an error message. Programmers have been known to yell at their computers when errors appear in their output. Maybe you've even felt that same frustration, but, as all programmers soon learn,

by Jean Plessner

FLASH!!!
The Kingdom
OF SHAMROCK
has LOST ITS
LUCKY 4-LEAF
CLOVER...

WAIT
THIS JUST
IN...

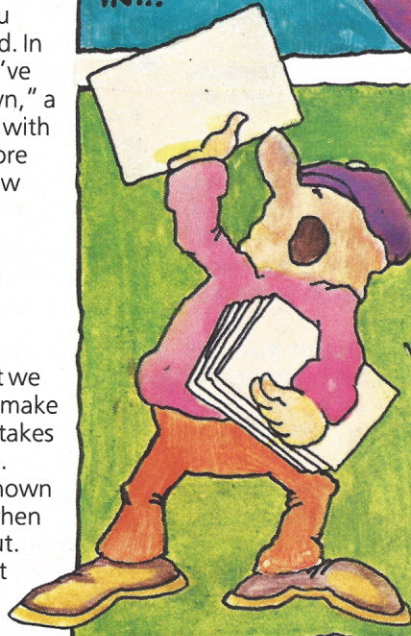
BUT IF YOU
OUTSMART
THE EVIL
LEPRECHAUN
and enter
the CITY YOU
WILL BECOME
THE NEW
King

HEY! HEY!!
LET'S BE
CAREFUL
OUT THERE!!!

16K Color Basic



whoever
can
REPLACE
THE
LUCKY
4-LEAF
CLOVER
WILL
BECOME
THE NEW
King...
...but
a wicked,
evil, mean,
and nasty
LEPRECHAUN
IS BLOCKING
THE
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"to err is human"-computers simply obey.

As you use operators to compare and sort data, it will be important to double-check your statements for accuracy and logic. Using logic is simply thinking out each step you must take to accomplish something. Remember, the computer doesn't know how to do anything without your giving it the logic, so if you miss a step or give it a wrong instruction it can't do the job correctly. Practice logic by thinking about telling your computer how to wash a car. You have to tell it where to find everything it needs, how to turn the hose on and off, how to wash each part, when to rinse, dry, clean the windows and so on. If you leave anything out you may end up with a running hose, an unwashed fender, dirty windows, or worse — a window that wasn't closed before the car was sprayed with water! Programmers must be careful and exact, but like all things, this comes with practice and will help you in many other areas of communications.

Computers rely on us for instructions, but we rely on them for speed. Computers work so incredibly fast we gladly take on the challenge of teaching them how to do our work for us. Once we give the computer instructions we can sit back, relax, stop thinking for awhile and let those mighty microchips go to work. Now let's give your computer a job to work on.

Find the Largest Number

As you enter Listing 1 into your computer's memory, read the explanations that follow for each line:

Line 10 is a remark statement (REM) that tells what the computer does.

Line 20 clears the screen.

Line 30 PRINTs a blank line at the top of the screen.

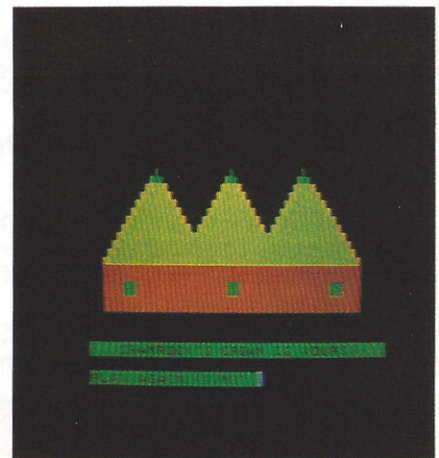
Lines 40 and 50 are INPUT statements, so you can enter two numbers into the program

Line 60 tests if the number you entered for A is equal to the number you entered for B. If the test is true (A=B) THEN the computer will GOTO the PRINT statement in Line 110. If the statement is false the computer will go on to the next program line.

Line 70 tests if A is greater than B. If that test is true, THEN the computer will GOTO Line 90. ELSE, when both tests have failed, the computer will PRINT B; "IS GREATER THAN"; A.

Line 80 sends the computer back to Line 30 and the program will repeat until you press the BREAK key.

Lines 90 through 120 are executed as a result of GOTO statements when a test is true, and the computer always returns



to Line 30.

After you RUN this program a few times you'll probably wonder why you really need it since you already know which number is largest when you enter them. The program isn't very helpful as it stands, but the logic and structure of the statements is important for future programs of your own. You won't always know what the numbers in a program are, but the logic remains the same.

Re-write the program to find the smallest number. You can use the < symbol and change the wording of the PRINT statements.

There will be times when you'll want to compare several numbers in a program. The logic involved is to compare one single variable with all the others in a statement. We can do this by using the word AND, which is also an operator.

Program Listing 2 shows you how to do this using three different variables. If you had more variables, you would just add more AND operators, more statement lines for testing each variable, and more PRINT statements. Type NEW, then enter Listing 2.

Line 70 tests if A is equal to, or greater than B AND C. The test must be true for both variables before the computer will GOTO Line 110.

Line 80 — if Line 70 was false the computer will go to this line. Here the computer tests the variable B. If B is equal to or greater than A AND C, THEN the computer will GOTO Line 130. If this condition is also false the computer will go on to the next line.

Line 90 is executed when Lines 70 and 80 have been false. The computer now knows that C is the largest number, or, if it is equal to another number, it still remains the largest number entered.

Once again, change this program to find the smallest number entered. For further practice add two variables together and find the largest or smallest of

the two totals. Here's an example of a test statement and a PRINT statement:

```
70 IF A+B=>A+C THEN 110
110 ? "THE TOTAL OF";A;"+";B;"IS GREATER
THAN";A;"+";C
```

Try changing the variables and the wording of the PRINT statements. Also, take some time to try out different ways to compare numbers.

Is A < Or > Z?

Alphabetizing means to put words or letters in the order of the alphabet. A word beginning with A would come before a word beginning with B, and so on. The computer alphabetizes by using the same operators we used to compare numbers, but we will now be using string (\$) variables.

The smallest value given to a letter is A, and Z is the largest value, so $A < Z$. In a program that alphabetizes names, the computer compares string data. For an example, if $N\$ = \text{"Jean"}$ and $D\$ = \text{"Robert"}$, the test statement would be: $\text{IF } N\$ < D\$ \text{ THEN...}$. The computer would look at the data in $N\$$, then it would look at the data in $D\$$, and compare them. Since "Jean" is less than "Robert" the statement would be true.

The alphabetizing program I've written uses an array to store the list of names that are INPUT into the program and another array to store the names in alphabetical order. The computer will then be comparing *subscripted* data. For example, $N\$(1) = \text{"Jean"}$ and $N\$(2) = \text{"Robert"}$, so the test statement would read: $\text{IF } N\$(1) < N\$(2) \text{ THEN...}$ and the computer would look at the data in $N\$(1)$, then the data in $N\$(2)$. (A subscript is a number attached to a variable string that uses the same variable to identify different data. The subscript gives each data entry a numerical order, or precedence.) When the lesser value name is found the computer will be instructed to cross out the name in the $N\$$ list and place that name in the subscripted alphabetical array. You may want to look back at last month's article for a review on arrays.

An Alphabetizing Program

After you enter the alphabetizing program (Listing 3), carefully read the explanation that follows it.

The Variables:

N\$() = an array for the list of names that will be INPUT.

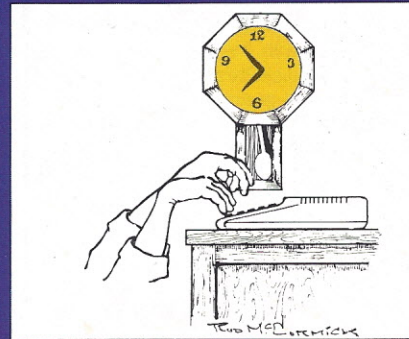
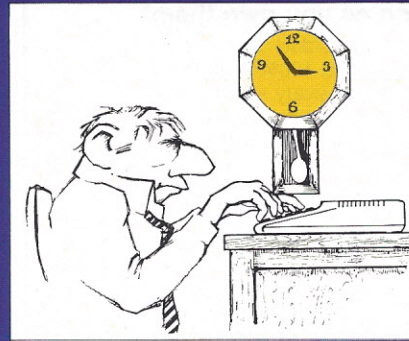
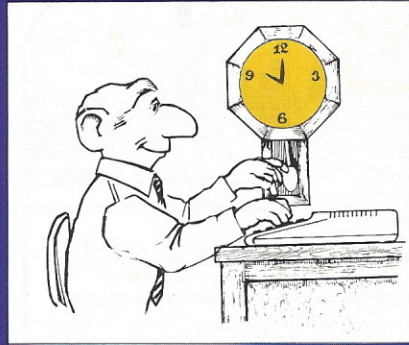
AN\$() = an array for the list of names as alphabetized.

L, P and A = variables that will contain values used in subscripts.

So I can better explain the program to you, use these names for the INPUT: PAULA, JEFF, DIANE, STEVE, DAVID.

Line 20 dimensions (DIM) $N\$$ and $AN\$$

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for five names.

Lines 50 to 80 are the INPUT section. L's value will subscript each name we enter. When all the names have been entered the N\$ array will contain: N\$(1)="PAULA"; N\$(2)="JEFF"; N\$(3)="DIANE"; N\$(4)="STEVE"; N\$(5)="DAVID".

Line 110 gives A the value of 1. The program uses A's value for another subscript of N\$ so we can compare two names in a test statement.

Line 120 is the beginning of a FOR/NEXT loop that will use P's value to subscript AN\$.

Line 130 is the beginning of a FOR/NEXT loop that will use L's value to subscript N\$.

Line 140 is a test statement that compares two names in the array N\$. If the statement is true, THEN A will equal L's value, or number.

Line 150 returns to Line 130 for the next value of L until all five N\$ names are checked and the lowest value is found.

Line 160 — when the computer reaches this line it has found the lowest name, alphabetically, and it is placed in the current subscript value of AN\$.

Line 170 — N\$(A) is the name placed alphabetically in AN\$(P). The name in N\$(A) is no longer needed, so we cross it off the list by placing Z's in its place.

Line 180 returns to Line 120 and the process begins again until P=5 and all the names are alphabetized.

This will become much clearer by following the program step-by-step as it finds the first name for our alphabetical list. After you have INPUT the names, this is what the computer does:

Line 110 — A=1

Line 120 — P=1

Lines 130 to 150 — repeat five times and the comparison looks like this: 140 IF N\$(L) < N\$(A) THEN A=L.

When L=1: Is Paula < Paula? NO,

THEN A=1

When L=2: Is Jeff < Paula? YES, THEN A=2

When L=3: Is Diane < Jeff? YES, THEN A=3

When L=4: Is Steve < Diane? NO, THEN A=3

When L=5: Is David < Diane? YES, THEN A=5

Since L=5, the loop ends and the computer goes to the next line: LINE 160 AN\$(P) = N\$(A), which means: AN\$(1) = "DAVID" because A = 5 and N\$(5) holds the name David.

Line 170 N\$(A) = "ZZZZ", so: N\$(5) = "ZZZZ". This replaces the name David with Z's; it's like crossing DAVID off the N\$ list so it can't be used again.

Line 180 sends the computer back to Line 120 and P=2.

The process begins again, but this time DAVID will not be on the list, so the next name that follows alphabetically will be found and put in AN\$(2), and so on until all the names are in AN\$ and all z's appear in N\$. The computer will then go on to the PRINT statements in Lines 210 to 260 and the alphabetical list will be printed.

When you RUN the program the results should look like this:

THE NAMES IN ALPHABETICAL ORDER ARE:

DAVID

DIANE

JEFF

PAULA

STEVE

This program will work for any list of words or names, so be sure to CSAVE it. If you want to alphabetize more than five words, change Lines 20,60,120,130 and 240 to the number of words in your list. You can also add telephone numbers and addresses to the list. If you have a printer, change Lines 220,230 and 250 to: PRINT #—2,...

Program Listing 1. Find the Largest Number

```
10 REM--THE LARGEST OF TWO NUMBE
RS
20 CLS
30 PRINT
40 INPUT "ENTER A NUMBER-->";A
50 INPUT "ANOTHER NUMBER-->";B
60 IF A=B THEN 110
70 IF A>B THEN 90 ELSE PRINT B;
"IS GREATER THAN";A
80 GOTO 30
90 PRINT A; "IS GREATER THAN";B
100 GOTO 30
110 PRINT A;"=";B
120 GOTO 30
```


Random Numbers

Random means out of order; your computer can select random numbers when you give it this statement: RND(X). X is replaced by the highest number you want and the numbers the computer selects will be from 0 to X.

To see how your computer does this, enter this program:

```
10 REM-RANDOM NUMBERS
20 FOR L=1 TO 100
30 X=RND(100)
40 ? X;
50 NEXT L
```

Each time the computer repeats the L loop it selects a random number from 0 to 100. The number will be printed for you to see. After you RUN the program a few times try other numbers in place of 100.

A Game of Random Numbers

I've written a game for you that was inspired by St. Patrick's Day. The program is a little long, so you may want to ask for help typing it. We've covered all the statements in this and past lessons so I'm sure with careful reading you'll be able to follow the logic.

"Shamrock's Crown" has simple graphics and sound, and hints to help you as you play. After you become familiar with the game, use it as a guide for writing your own game.

The plot: The Kingdom of Shamrock has lost its lucky four-leaf clover. Bad luck is destroying the peaceful Kingdom and the subjects are offering the throne to

anyone who brings a new four-leaf clover to Shamrock.

The luck of the Irish is with you, and you have found a four-leaf clover! But reaching Shamrock with your find will not be easy. A nasty leprechaun wants the crown of Shamrock also, and he is guarding the only entrance to the Kingdom—a bridge that can be crossed only after challenging the leprechaun.

The leprechaun thinks of a number from 0 to 20 and allows you four chances to guess it. I know I said the leprechaun was nasty, but he's also fair, and he'll tell you if your guess is too high or too low.

If you guess the correct number before your chances are up you are free to enter Shamrock and claim the crown, but if you fail you must pay the toll and the four-leaf clover goes to the leprechaun and he becomes the nasty new ruler of Shamrock!!

The Variables:

B\$ = a stop in the program until you press <ENTER>.

N = a random number from 0 to 20.

G = your guess.

A to F = horizontal and vertical positions for the graphics.

P\$ = your answer to the prompt: PLAY AGAIN (Y/N)?

You can make the game harder by changing the random number value to a larger number or by changing the guesses to less than four. Have fun and good luck!

Next month we're going to teach our computer to read. No, not novels, but to a computer, DATA statements are the next best thing.

See you in April!

■ ■ ■
♦ Programs

Program Listing 2. Using More Than Three Variables

```
10 REM--LARGEST # OF THREE
20 CLS
30 PRINT
40 INPUT "ENTER A NUMBER-->";A
50 INPUT "ANOTHER NUMBER-->";B
60 INPUT "ANOTHER NUMBER-->";C
70 IF A=>B AND A=>C THEN 110
80 IF B=>A AND B=>C THEN 130
90 PRINT C;"IS THE LARGEST NUMBE
R"
100 GOTO 30
110 PRINT A;"IS THE LARGEST NUMB
ER"
120 GOTO 30
130 PRINT B;"IS THE LARGEST NUMB
ER"
140 GOTO 30
```

■ ■ ■

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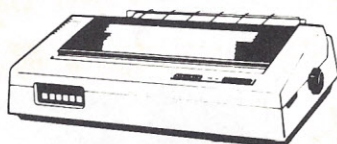
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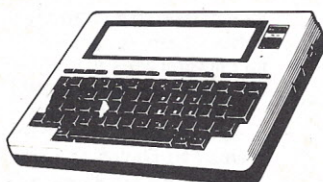
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Program Listing 3. An Alphabetizing Program

```

10 REM--ALPHABETIZING PROGRAM
20 DIM N$(5),AN$(5)
30 CLS:PRINT
50 REM--TO INPUT NAMES:
60 FOR L=1 TO 5
70 INPUT "A NAME-->";N$(L)
80 NEXT L
100 REM--TO TEST & COMPARE:
110 A=1
120 FOR P=1 TO 5
130 FOR L=1 TO 5
140 IF N$(L) < N$(A) THEN A=L
150 NEXT L
160 AN$(P)=N$(A)
170 N$(A)="ZZZZ"
180 NEXT P
200 REM--PRINTS ALPHABETICAL LIS
T
210 CLS:PRINT
220 PRINT "THE NAMES IN ALPHABET
ICAL ORDER ARE:"
230 PRINT:PRINT
240 FOR L=1 TO 5
250 PRINT " ";AN$(L)
260 NEXT L
270 END
    
```

Program Listing 4. Shamrock's Crown

```

10 REM--SHAMROCK'S CROWN
20 CLS:PRINT
30 PRINT " YOU HAVE 4 CHANCES T
O GUESS"
40 PRINT "THE LEPRECHAUN'S SECRE
T NUMBER."
50 PRINT " <A NUMBER FROM 0 T
O 20>"
60 PRINT "IF YOU ARE CORRECT, TH
E LEPRE-"
70 PRINT "CHAUN WILL ALLOW YOU T
O ENTER"
80 PRINT "SHAMROCK WITH THE FOUR
-LEAF"
90 PRINT "CLOVER THAT WILL WIN Y
OU THE"
100 PRINT "CROWN OF SHAMROCK. B
UT, IF YOU"
110 PRINT "FAIL, THE LEPRECHAUN
WINS YOUR"
120 PRINT "CLOVER AND BECOMES TH
E NEW"
130 PRINT "RULER OF SHAMROCK."
140 PRINT:PRINT "WHEN YOU ARE RE
ADY TO BEGIN"
    
```



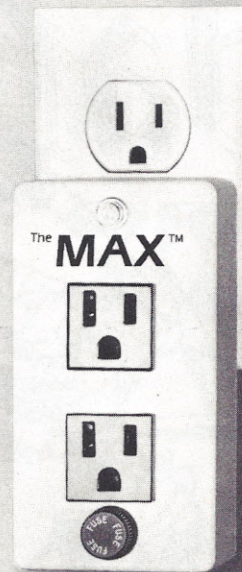
```

150 INPUT "YOUR CHALLENGE PRESS
<ENTER>";B$
160 CLS:PRINT:N=RND(20)
170 FOR L=1 TO 4
180 PRINT "GUESS #";L;:INPUT "--
->";G
190 IF G=N GOTO 320
200 IF G>N THEN SOUND 200,5:PRIN
T "TOO HIGH"
210 IF G<N THEN SOUND 100,5:PRIN
T "TOO LOW"
220 NEXT L
230 REM--LEPRECHAUN WINS
240 CLS
250 PRINT@105,"THE LEPRECHAUN"
260 PRINT@165,"HAS WON YOUR CLOV
ER!!"
270 FOR S=100 TO 10 STEP -5
280 SOUND S,3:NEXT S
290 PRINT:PRINT
300 PRINT " THE CORRECT NUMBER W
AS-->";N
310 GOTO 530
320 REM--YOU WON!!
330 CLS(0):A=13:B=15:C=29:D=31:E
=45:F=47
340 FOR V=5 TO 11
350 FOR X=A TO B:SET(X,V,2):NEXT
X
360 FOR Y=C TO D:SET(Y,V,2):NEXT
Y
370 FOR Z=E TO F:SET(Z,V,2):NEXT
Z
380 A=A-1:B=B+1:C=C-1:D=D+1:E=E-
1:F=F+1
390 NEXT V
400 A=6:B=54
410 FOR V=12 TO 15
420 FOR H=A TO B:SET(H,V,2)
430 NEXT H
440 A=A-1:B=B+1
450 NEXT V
460 FOR V=16 TO 21
470 FOR H=3 TO 57
480 SET(H,V,8)
490 NEXT H,V
500 SET(8,18,1):SET(30,18,1):SET
(52,18,1)
510 SET(14,4,1):SET(30,4,1):SET(
46,4,1)
520 PRINT@416," SHAMROCK'S CRO
WN IS YOURS!!"
530 PRINT@480,"PLAY AGAIN (Y/N)"
;:INPUT P$
540 IF P$="Y" GOTO 160
550 IF P$="N" THEN END ELSE GOTO
530

```

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Color Computer/93



by Stephen Ritger

THIS PROGRAM CONVERTS a message entered at the keyboard to its Morse Code equivalent, producing "dits" and "dahs" via your TV. You can change the tone by changing the value of the sound command in Line 150.

Using the fact that each letter and number has an ASCII value assigned to it I set up an array, called MC\$. This contains the sound information for each character, indexed under its ASCII value. The array AS contains the ASCII information for each respective character.

I have included data for all the basic codes in the International Morse Code. If you wish to add your own special characters, simply add on to the data statements in Lines 280 – 290. Make sure the code for your character doesn't duplicate one of the codes already in the data statements. The tones are encoded by numbers, with the number 1 equal to a "dit" (dot), and the number 3 equal to a "dah" (dash). For example, the letter A, whose ASCII number is 65, has the code 13, which stands for "dit-dah." The letter Z, whose ASCII number is 90, has the code 3311, which stands for "dah-dah-dit-dit."

Morse Code Generator

Dits and Dahs on your TV

Program Listing. Morse Code

```

10 ' MORSE CODE GENERATOR
20 ' BY STEVE RITGER
40 CLS: CLEAR 255: GOSUB 210
50 M$= "          MORSE CODE GENERATO
R          BY STEVE RITGER"
:GOTO 80
60 CLS: LINEINPUT "ENTER MESSAGE
- ";M$
70 IF M$= "" THEN 60
80 CLS
90 FOR L = 1 TO LEN(M$)
100 PRINT MID$(M$,L,1);
110 A= ASC(MID$(M$,L,1))
120 FOR SND= 1 TO LEN(MC$(A))
130 V= VAL(MID$(MC$(A),SND,1))
140 IF V= 0 THEN 170
150 SOUND 176,V
160 FOR DL= 1 TO 20: NEXT DL
170 NEXT SND
180 FOR DL= 1 TO 50: NEXT DL: NE
XT L
190 FOR DL= 1 TO 2000: NEXT DL
200 GOTO 60
210 ' DEFINE MORSE CODE
220 DIM MC$(127)
230 FOR Q= 1 TO 36
240 READ Z1: READ MC$(Z1)
250 NEXT Q
260 RETURN
270 ' MORSE CODE DATA
280 DATA 48,33333,49,13333,50,11
333,51,11133,52,11113,53,11111,5
4,31111,55,33111,56,33311,57,333
31,65,13,66,3111,67,3131,68,311,
69,1,70,1131,71,331,72,1111,73,1
1,74,1333,75,313,76,1311,77,33,7
8,31,79,333,80,1331,81,3313,82,1
31,83,111,84,3,85,113,86,1113
290 DATA 87,133,88,3113,89,3133,
90,3311

```



16K Color Basic

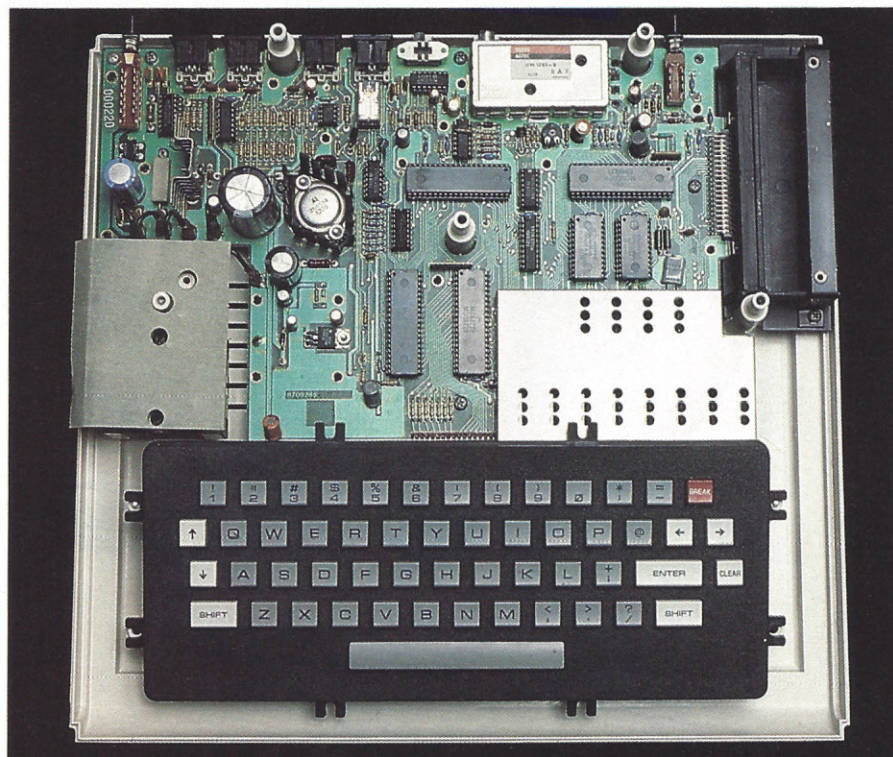


photo by Charley Freiberg

Dissecting Your ROM

Part seven of a fourteen-part series.

AT LAST WE'VE REACHED an important part of the journey through the ROM — the end of part one. Address \$BFFF represents an unexpected halfway point in the series. Color Basic (the un-Extended version) is complete up to this point. I'd like to extend my gratitude to Terry Kepner for invaluable assistance in transcribing this hefty tome.

For the majority of you with Extended Color Basic, the disassembly resumes not at address \$C000 (immediately following \$BFFF) as you might expect, but lower down in memory at location \$8000. The ROM area from \$C000 and up is reserved for the cartridge slot, and may contain Disk Basic, EDTASM+ or whatever ROM you happen to have plugged in there.

The floating point math routines take up most of this month's portion of ROM. Floating point routines are guaranteed to give you a headache, not so much because they're complicated but because

by Jake Commander

they're tedious. One of the luxuries of programming mainframe computers is that you can perform floating point arithmetic through the computer's execution of a single instruction. Just say FPAD to the assembler on many big machines and that's the end of any floating point addition problem.

On a micro, however, things are more longwinded. Without such powerful opcodes, it becomes necessary to manipulate floating point numbers byte by byte, taking separate account of the exponent byte and the mantissa portion. It's this juggling of bits and bytes at the mantissa level which takes up much of the body of this code.

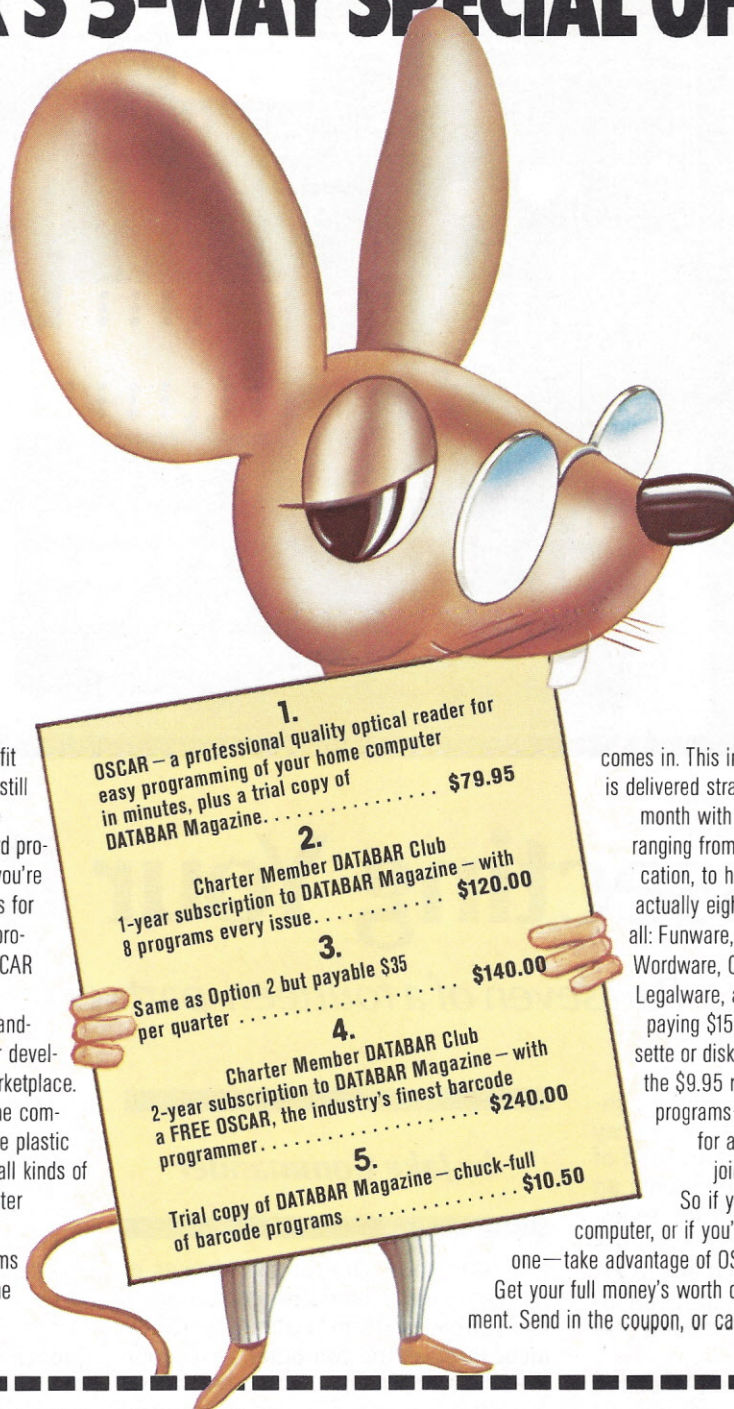
Without getting into a treatise on the binary floating point system, here are the

rudiments. The mantissa represents the number itself (i.e., the digits that comprise the number), and the exponent represents the number of digits to move the decimal point for correct location. As we're talking in binary, the number in the mantissa is binary (not decimal) and the exponent is therefore really the location of the *binary* point. To ensure maximum precision, no leading zeroes are stored in the mantissa and the binary point is always assumed to be at the left hand side of it. Consequently, the exponent will contain a positive or negative number representing the number of bits to count to locate the binary point.

In the Color Computer, there are four bytes in the mantissa and one in the exponent. This format is what gives us the nine decimal digits of precision in all numerical calculations. This medium precision makes life a lot easier in the ROM, as no routines are required to distinguish between single and double precision arithmetic.

◆ ◆ ◆
◆ Program

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Program Listing. ROM Dissection

Line Number	Address	Object Code	Mnemonic	Operand	Jake's Comment			
FPAC1	+ 0.5							
03230	B9B4	8E BEC0	LDX	#\$BEC0	;Floating point # 0.5	03288	BA29	96 53 LDA <\$53 ; 8
03231	B9B7	20 09	BRA	\$B9C2	;Add 0.5 to FPAC1	03289	BA2B	97 52 STA <\$52 ; bits
03232	B9B9	BD BB2F	JSR	\$BB2F	;(X) (variable format) to FPAC2	03290	BA2D	96 63 LDA <\$63 ;Move last truncated byte...
03233	B9BC	03 54	COM	<\$54	;Change sign of FPAC1	03291	BA2F	97 53 STA <\$53 ;...into LSB
03234	B9BE	03 62	COM	<\$62	;Change sign of result	03292	BA31	0F 63 CLR <\$63 ;Zero least significant byte
03235	B9C0	20 03	BRA	\$B9C5		03293	BA33	CB 08 ADDB #8 ;Bump number shifts plus eight
03236	B9C2	BD BB2F	JSR	\$BB2F	;VARPTR (x) to FPAC2	03294	BA35	C1 28 CMPB #\$28 ;All possible bits shifted?
03237	B9C5	5D	TSTB		;Exponent FPAC1	03295	BA37	2D E4 BLT \$BA1D ;Shift again if not
03238	B9C6	1027 0280	LBEQ	\$BC4A	;If FPAC1=0, cpy FPAC2 to FPAC1	03296	BA39	4F CLRA ;Return FPAC1=0
03239	B9CA	8E 005C	LDX	#\$005C	;=> FPAC2	03297	BA3A	97 4F STA <\$4F ;Zero exponent
03240	B9CD	1F 89	TFR	A,B	;FPAC2 exponent to B	03298	BA3C	97 54 STA <\$54 ;Set sign positive
03241	B9CF	5D	TSTB		;Zero?	03299	BA3E	39 RTS
03242	B9D0	27 6C	BEQ	\$BA3E	;If FPAC2=0, FPAC1 alrdy corrcot	Get Non-zero most significant bit		
03243	B9D2	D0 4F	SUBB	<\$4F	;FPAC2 exponnt - FPAC1 exponnt	03300	BA3F	8D 6D BSR \$BAAE ;Align FPAC
03244	B9D4	27 69	BEQ	\$BA3F	;If mantisas aligned	03301	BA41	5F CLR B ;Carry flag off
03245	B9D6	2B 0A	BMI	\$B9E2	;If FPAC1 > FPAC2	03302	BA42	20 A8 BRA \$B9EC ;Add/subtract FPAC1/2
03246	B9D8	97 4F	STA	<\$4F	;FPAC2 exponent to FPAC1	03303	BA44	5C INCB ;Bump number of shifts
03247	B9DA	96 61	LDA	<\$61	;Transfer Least Signif ant Byte	03304	BA45	08 63 ASL <\$63 ;Carry-out byte
03248	B9DC	97 54	STA	<\$54		03305	BA47	09 53 ROL <\$53 ;*Shift FPAC1
03249	B9DE	8E 004F	LDX	#\$004F	;=> FPAC1	03306	BA49	09 52 ROL <\$52 ;*left
03250	B9E1	50	NEGB		;Minus # bits to align	03307	BA4B	09 51 ROL <\$51 ;*one
03251	B9E2	C1 F8	CMPB	#\$F8	< 8 bits?	03308	BA4D	09 50 ROL <\$50 ;*bit
03252	B9E4	2F 59	BLE	\$BA3F	;No, do bitwise	03309	BA4F	2A F3 BPL \$BA44 ;Shift again if MSB bit7 not set
03253	B9E6	4F	CLRA		;Carry flag off	03310	BA51	96 4F LDA <\$4F ;Unnormalized exponent
03254	B9E7	64 01	LSR	1,X	;Shift right MSB	03311	BA53	34 04 PSHS B ; A - B Normalize exponent
03255	B9E9	BD BABA	JSR	\$BABA	;Shift right -B bits FPAC1	03312	BA55	A0 E0 SUBA ;,+
03256	B9EC	D6 62	LDB	<\$62	;Sign of result	03313	BA57	97 4F STA <\$4F ;Normalized exponent to FPAC1
03257	B9EE	2A 0B	BPL	\$B9FB	;If positive	03314	BA59	23 DE BLS \$BA39 ;Return zero if underflow
03258	B9F0	63 01	COM	1,X	;Else complement FPAC1	03315	BA5B	8C 2508 CMPX #\$2508
03259	B9F2	63 02	COM	2,X		-----	BA5C	25 08 BLO \$BA66 ;
03260	B9F4	63 03	COM	3,X		03316	BA5E	08 63 ASL <\$63 ;Set carry if round-up required
03261	B9F6	63 04	COM	4,X		03317	BA60	86 00 LDA #0 ;Zero least significant byte
03262	B9F8	43	COMA			03318	BA62	97 63 STA <\$63 ;Don't change carry flag
03263	B9F9	89 00	ADCA	#0		03319	BA64	20 0C BRA \$BA72
03264	B9FB	97 63	STA	<\$63	;Round-off byte	03320	BA66	0C 4F INC <\$4F ;Bump exponent
03265	B9FD	96 53	LDA	<\$53	;*Add	03321	BA68	27 28 BEQ \$BA92 ;?OV Error if over the top
03266	B9FF	99 60	ADCA	<\$60	;	03322	BA6A	06 50 ROR <\$50 ;*Shift
03267	BA01	97 53	STA	<\$53	;*FPAC1	03323	BA6C	06 51 ROR <\$51 ;*FPAC1
03268	BA03	96 52	LDA	<\$52	;	03324	BA6E	06 52 ROR <\$52 ;*right
03269	BA05	99 5F	ADCA	<\$5F	;*to	03325	BA70	06 53 ROR <\$53 ;*one bit
03270	BA07	97 52	STA	<\$52	;	03326	BA72	24 04 BHS \$BA78 ;RTS if no rounding required
03271	BA09	96 51	LDA	<\$51	;*ACC2	03327	BA74	8D 0D BSR \$BA83 ;Bump mantissa to round up
03272	BA0B	99 5E	ADCA	<\$5E	;	03328	BA76	27 EE BEQ \$BA66 ;Next bit
03273	BA0D	97 51	STA	<\$51	;*in	03329	BA78	39 RTS
03274	BA0F	96 50	LDA	<\$50	;	Negate FPAC1		
03275	BA11	99 5D	ADCA	<\$5D	;*FPAC1	03330	BA79	03 54 COM <\$54 ;Complement sign bit
03276	BA13	97 50	STA	<\$50	;	03331	BA7B	03 50 COM <\$50 ;*Mantissa
03277	BA15	5D	TSTB		;Sign of result?	03332	BA7D	03 51 COM <\$51 ;*all
03278	BA16	2A 44	BPL	\$BA5C	;If positive	03333	BA7F	03 52 COM <\$52 ;*complemented
Floating point normalize						03334	BA81	03 53 COM <\$53 ;*
03279	BA18	25 02	BLO	\$BA1C	;If MSB is positive	03335	BA83	9E 52 LDX <\$52 ;LSW FPAC1 + 1
03280	BA1A	8D 5D	BSR	\$BA79	;Negate FPAC1	03336	BA85	30 01 LEAX 1,X
03281	BA1C	5F	CLRB		;Initialize exponent	03337	BA87	9F 52 STX <\$52
03282	BA1D	56 50	LDA	<\$50	;Most significant byte	03338	BA89	26 06 BNE \$BA91 ;RTS if no carry
03283	BA1F	26 2E	BNE	\$BA4F	;If MSB is non-zero	03339	BA8B	9E 50 LDX <\$50 ;Else MSW FPAC1 + 1
03284	BA21	96 51	LDA	<\$51	;MSB	03340	BA8D	30 01 LEAX 1,X
03285	BA23	97 50	STA	<\$50	; Shift	03341	BA8F	9F 50 STX <\$50
03286	BA25	96 52	LDA	<\$52	; FPAC1	03342	BA91	39 RTS
03287	BA27	97 51	STA	<\$51	; left			

more

Line Number	Address	Object Code	Mnemonic	Operand	Jake's Comment
2OV Error					
03343	BA92 C6 0A		LDB	#\$0A	;Error code
03344	BA94 7E AC46		JMP	\$AC46	;Error processing
Align FPAC					
03345	BA97 8E 0012		LDX	#\$0012	;=> FPAC3
03346	BA9A A6 04		LDA	4,X	;Carry-out byte
03347	BA9C 97 63		STA	<\$63	
03348	BA9E A6 03		LDA	3,X	;Next LSB to LSB
03349	BAA0 A7 04		STA	4,X	
03350	BAA2 A6 02		LDA	2,X	;Next MSB to next MSB
03351	BAA4 A7 03		STA	3,X	
03352	BAA6 A6 01		LDA	1,X	;MSB to next MSB
03353	BAA8 A7 02		STA	2,X	
03354	BAAA 96 5B		LDA	<\$5B	;Carry-in Byte
03355	BAAE A7 01		STA	1,X	;To MSB
03356	BAAE CB 08		ADDB	#8	;Set B postv if <8 bits to shift
03357	BAB0 2F E8		BLE	\$BA9A	;Another 8 bits if no underflow
03358	BAB2 96 63		LDA	<\$63	;Carry-out shifted also
03359	BAB4 C0 08		SUBB	#8	;Readjust for previous underflow
03360	BAB6 27 0C		BEQ	\$BAC4	;RTS if alignment is complete
03361	BAB8 67 01		ASR	1,X	;MSB
03362	BABA 66 02		ROR	2,X	;Next MSB
03363	BABC 66 03		ROR	3,X	;Next LSB
03364	BABE 66 04		ROR	4,X	;LSB
03365	BAC0 46		RORA		;Carry-out byte
03366	BAC1 5C		INCB		;One less bit to do
03367	BAC2 26 F4		BNE	\$BAB8	;If more bits
03368	BAC4 39		RTS		
Floating point constant = 1.0					
03369	BAC5 81 00		CMPL	#0	
03370	BAC7 00 00		NEG	<0	
Floating point multiply					
03371	BAC9 00 8D		NEG	<\$8D	;Incorrect disassembly
-----	BACA 8D 63		BSR	\$63	;Varptr (X) to FPAC2
Entry Point for FPAC2 * FPAC1					
03372	BACC 27 60		BEQ	\$60	;RTS if FPAC1 equals zero, RTS
03373	BACE 8D 78		BSR	\$78	;Add exponents
03374	BAD0 86 00		LDA	\$0	
03375	BAD2 97 13		STA	<\$13	;*Zero
03376	BAD4 97 14		STA	<\$14	;*mantissa
03377	BAD6 97 15		STA	<\$15	;*of
03378	BAD8 97 16		STA	<\$16	;*FPAC3
03379	BADA D6 53		LDB	<\$53	;LSB FPAC1
03380	BADC 8D 22		BSR	\$BB00	;Form multiply in FPAC3
03381	BADE D6 63		LDB	<\$63	;Save truncated byte
03382	BAE0 D7 AE		STB	<\$AE	
03383	BAE2 D6 52		LDB	<\$52	;Next LSB of FPAC1
03384	BAE4 8D 1A		BSR	\$BB00	;Form multiply in FPAC3
03385	BAE6 D6 63		LDB	<\$63	;Save truncated byte
03386	BAE8 D7 AD		STB	<\$AD	
03387	BAEA D6 51		LDB	<\$51	;Next MSB of FPAC1
03388	BAEC 8D 12		BSR	\$BB00	;Form multiply in FPAC3
03389	BAEE D6 63		LDB	<\$63	;Save truncated byte
03390	BAF0 D7 AC		STB	<\$AC	
03391	BAF2 D6 50		LDB	<\$50	;MSB of FPAC1
03392	BAF4 8D 0C		BSR	\$BB02	; (can't =0) Form multiply in FPAC3
03393	BAF6 D6 63		LDB	<\$63	;Save truncated byte

Line Number	Address	Object Code	Mnemonic	Operand	Jake's Comment
03394	BAF8 D7 AB		STB	<\$AB	
03395	BAFA BD BC0B		JSR	\$BC0B	;Move FPAC3 mantissa to FPAC1
03396	BAFD 7E BA1C		JMP	\$BA1C	;Normalize
03397	BB00 27 95		BEQ	\$BA97	;If zero byte shift right 8 bits
03398	BB02 43		COMA		;Carry flag off
03399	BB03 96 13		LDA	<\$13	;MSB FPAC3
03400	BB05 56		RORB		;Least Sign Bit to carry flag
03401	BB06 27 26		BEQ	\$BB2E	;RTS if done all bits
03402	BB08 24 16		BHS	\$BB20	;LSB = 0 don't add
03403	BB0A 96 16		LDA	<\$16	;*Add
03404	BB0C 9B 60		ADDA	<\$60	;*FPAC2
03405	BB0E 97 16		STA	<\$16	;*mantissa
03406	BB10 96 15		LDA	<\$15	;*to
03407	BB12 99 5F		ADCA	<\$5F	;*FPAC3
03408	BB14 97 15		STA	<\$15	;*mantissa
03409	BB16 96 14		LDA	<\$14	;*
03410	BB18 99 5E		ADCA	<\$5E	;*
03411	BB1A 97 14		STA	<\$14	;*
03412	BB1C 96 13		LDA	<\$13	;*
03413	BB1E 99 5D		ADCA	<\$5D	;*
03414	BB20 46		RORA		; Shift
03415	BB21 97 13		STA	<\$13	; FPAC3
03416	BB23 06 14		ROR	<\$14	; right
03417	BB25 06 15		ROR	<\$15	; one
03418	BB27 06 16		ROR	<\$16	; bit
03419	BB29 06 63		ROR	<\$63	;Save truncated bit
03420	BB2B 4F		CLRA		;Carry flag off
03421	BB2C 20 D5		BRA	\$BB03	;Continue
03422	BB2E 39		RTS		
Variable format F.P. number at (X) to FPAC2					
03423	BB2F EC 01		LDD	1,X	;Most Significant Word
03424	BB31 97 61		STA	<\$61	;Save MSB for sign
03425	BB33 8A 80		ORA	#\$80	;Set most signif bit anyway
03426	BB35 DD 5D		STD	<\$5D	;To most significant word FPAC2
Set sign FPAC2 * FPAC1					
03427	BB37 D6 61		LDB	<\$61	;Sign in bit seven of FPAC1
03428	BB39 D8 54		EORB	<\$54	;Set minus if signs differ
03429	BB3B D7 62		STB	<\$62	;Save sign of result
03430	BB3D EC 03		LDD	3,X	;Least significant word
03431	BB3F DD 5F		STD	<\$5F	;To FPAC2
03432	BB41 A6 84		LDA	,X	;Move exponent
03433	BB43 97 5C		STA	<\$5C	;to FPAC2
03434	BB45 D6 4F		LDB	<\$4F	;Get FPAC1 exponent
03435	BB47 39		RTS		
Add exponent #1 to exponent #2					
03436	BB48 4D		TSTA		;Exponent FPAC2
03437	BB49 27 16		BEQ	\$BB61	;If zero, set FPAC1 = 0
03438	BB4B 9B 4F		ADDA	<\$4F	;Exp #1 plus Exp #2
03439	BB4D 46		RORA		;Carry flag to bit seven
03440	BB4E 49		ROLA		;Check for overflow
03441	BB4F 28 10		BVC	\$BB61	;Possible overflow
03442	BB51 8B 80		ADDA	#\$80	;Restore bias
03443	BB53 97 4F		STA	<\$4F	;Into FPAC1
03444	BB55 27 0C		BEQ	\$BB63	;If zero, set FPAC1 = 0
03445	BB57 96 62		LDA	<\$62	;Sign of result
03446	BB59 97 54		STA	<\$54	;Becomes sign for FPAC1
03447	BB5B 39		RTS		♦ more



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4

Check possible overflow
03448 BB5C 96 54
03449 BB5E 43
03450 BB5F 20 02
03451 BB61 32 62
03452 BB63 102A FED2
03453 BB67 7E BA92

FPAC1 * 10

03454 BB6A BD BC5F
03455 BB6D 27 0D
03456 BB6F 8B 02
03457 BB71 25 F4
03458 BB73 0F 62
03459 BB75 BD B9CD
03460 BB78 0C 4F
03461 BB7A 27 EB
03462 BB7C 39

Floating point constant 10.0

03463 BB7D 84 20
03464 BB7F 00 00
03465 BB81 00 BD
03466 BB83 BC 5F8E
03467 BB86 BB 7D5F
----- BB82 BD BC5F
----- BB85 8E BB7D
----- BB88 5F
03468 BB89 D7 62
03469 BB8B BD BC14

LDA <\$54
COMA
BRA \$BB63
LEAS 2,S
LBPL \$BA39
JMP \$BA92

JSR \$BC5F
BEQ \$BB7C
ADDA #2
BLO \$BB67
CLR <\$62
JSR \$B9CD
INC <\$4F
BEQ \$BB67
RTS

ANDA #\$20
NEG <0
NEG <\$BD
CMPX \$5F8E
ADDA \$7D5F
JSR \$BC5F
LDX \$BBB7D
CLRB
STB <\$62
JSR \$BC14

;FPAC1 sign in bit 7
;Reverse sign
;Pull return off stack
;Set FPAC1 = 0
;POV Error

;Copy FPAC1 to FPAC2
;RTS if exponent equals zero
;Exponent times four
;If overflow
;Sign of FPAC1 times FPAC2
;FPAC1 = FPAC1 + FPAC2 times 5
;times ten
;If overflow

;Disassembly out of sync
;Disassembly out of sync
;Disassembly out of sync
;Copy FPAC1 to FPAC2
;=> F.P. # 10
;Sign of FPAC1 times FPAC2
;Copy (=> X) to FPAC1

03499 BBC8 27 2E
03500 BBCA C6 01
03501 BBCC 1F 8A
03502 BBCE 25 0E
03503 BBDD 08 60
03504 BBDE 09 5F
03505 BBDA 09 5E
03506 BBD6 09 5D
03507 BBD8 25 E3

03508 BBDA 2B C8
03509 BBDC 20 DF
03510 BBDE 96 60
03511 BBEO 90 53
03512 BBED 97 60
03513 BBEE 96 5F
03514 BBEE 92 52
03515 BBEE 97 5F
03516 BBEE 96 5E
03517 BBEE 92 51
03518 BBEE 97 5E
03519 BBEE 96 5D
03520 BBEE 92 50
03521 BBEE 97 5D
03522 BBEE 20 D8
03523 BBEE C6 40
03524 BBEE 20 D0
03525 BBEE 56
03526 BBEE 56
03527 BBEE 56

BEQ \$BBF8
LDB #1
TFR A,CCR
BLO \$BBDE
ASL <\$60
ROL <\$5F
ROL <\$5E
ROL <\$5D
BLO \$BBBD

BMI \$BBA4
BRA \$BBBD
LDA <\$60
SUBA <\$53
STA <\$60
LDA <\$5F
SBCA <\$52
STA <\$5F
LDA <\$5E
SBCA <\$51
STA <\$5E
LDA <\$5D
SBCA <\$50
STA <\$5D
BRA \$BBDD
LDB #\$40
BRA \$BBCC
RORB
RORB
RORB

;If done 4
;Reinit B for another 8 bits
;Restore 0 or 1 to carry flag
;If divides, subtract divisor
;* Align
;*FPAC2 (dividend)
;* one bit
;* left
;If carry from FPAC2 MSB,
;shift 1 to result
;Another cmpre if bit7 FPAC2 MSB
;Else shift 0 to result
;*FPAC2
;*mantissa
;*minus
;*FPAC1
;*mantissa
;*result
;*into
;*FPAC2
;*
;*
;*
;*
;Initialize B for another 3 bits
;Form excess bits
;*Align
;*excess byte
;* to bits 5-7

03470	BB8E 8C 8D9E	CMFX	;\$8D9E	Mask for following opcode	03528	BBFF D7 63	STB	<\$63	;Save excess
03471	BB9F 8D 9E	BSR	\$BB2F	;Floating Point (X) to FPAC2	03529	BC01 8D 08	BSR	\$BC0B	;FPAC3 mantissa to FPAC1
03472	BB91 2D 73	BEQ	\$BC06	;/0 Error	03530	BC03 7E BAlC	JMP	\$BAlC	;F.P. normalize
03473	BB95 00 4F	NEG	<\$4F	;Negative Exp #1. Exp#2-Exp#1					
03474	BB95 8D B1	BSR	\$BB48	Add Exponents					
03475	BB97 0C 4F	INC	<\$4F	Adjust FPAC1 exponent +1	;/0 Error				
03476	BB99 27 CC	BEQ	\$BB67	;/ overflow	03531	BC06 C6 14	LDB	#\$14	;Error code
03477	BB9B 8E 0013	LDX	#\$0013	;/> FPAC3	03532	BC08 7E AC46	JMP	\$AC46	;Error processing
03478	BB9E C6 04	LDB	#4	;Number of mantissa bytes to do					
03479	BBAA D7 03	STB	<3	;Hold in scratch location	FPAC3 mantissa to FPAC1				
03480	BBAA 26 01	LDB	#1	;init B to shift in 8 bits	03533	BC0B 9E 13	LDX	<\$13	;Most significant word
03481	BBAA 96 50	LDA	<\$50	;FPAC1 MSB (divisor)	03534	BC0D 9F 50	STX	<\$50	
03482	BBAA 91 5D	CMFA	<\$5D	;FPAC2 MSB (dividend)	03535	BC0F 9E 15	LDX	<\$15	;Least significant word
03483	BBAA 26 13	BNE	\$BBBD	;If different	03536	BC11 9F 52	STX	<\$52	
03484	BBAA 96 51	LDA	<\$51	;FPAC1 next MSB	03537	BC13 39	RTS		
03485	BBAA 91 5E	CMFA	<\$5E	;FPAC2 next MSB	Setup FPAC1 from (X)				
03486	BBAA 26 0D	BNE	\$BBBD	;If different	03538	BC14 34 02	PSHS	A	
03487	BBAA 96 52	LDA	<\$52	;FPAC1 next LSB	03539	BC16 EC 01	LDD	1,X	;MSB's
03488	BBAA 26 07	BNE	\$BBBD	;FPAC2 next LSB	03540	BC18 97 54	STA	<\$54	;Save MSB for sign
03489	BBAA 96 53	LDA	<\$53	;FPAC1 LSB	03541	BC1A 8A 80	ORA	#80	;Bit seven always one
03490	BBBA 91 60	CMFA	<\$60	;FPAC2 LSB	03542	BC1C DD 50	STD	<\$50	;Store MSB's
03491	BBBA 26 01	BNE	\$BBBD	;If different	03543	BC1E 0F 63	CLR	<\$63	;Truncated byte = zero
03492	BBBC 43	COMA		;Set carry flag (goes in once)	03544	BC20 E6 84	LDB	X	;Exponent
03493	BBBD 1F A8	TFR	CCR,A	;Hold divide bit(carry flag) in A	03545	BC22 AE 03	LDX	3,X	;LSB's
03494	BBBF 59	ROLB		;Move in current divide-bit	03546	BC24 9F 52	STX	<\$52	
03495	BBBC 24 0A	BHS	\$BBCC	;If not done 8 bits	03547	BC26 D7 4F	STB	<\$4F	;Exponent
03496	BBBC E7 80	STB	X+	;Current mantissa byte to FPAC3	03548	BC28 35 82	PULS	A,PC	
03497	BBBC 0A 03	DEC	<3	;Done all 4 mantissa bytes?					
03498	BBBC 2B 34	BMI	\$BBFC	;Out if done 5	03549	BC2A 8E 0045	LDX	#80045	;Scratch#2 = destination
					03550	BC2D 20 06	BRA	\$BC35	;Copy FPAC1 to scratch#2



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Line Number	Address	Object Code	Mnemonic	Operand	Jake's Comment
Copy FPAC1 to variable or scratch					
03551	BC2F 8E 0040		LDX	#\$0040	;Scratch#1 = destination
03552	BC32 8C 9E3B		CMPX	#\$9E3B	;Mask for following opcode
-----	BC33 9E 3B		LDX	<3B	;Variable = destination
03553	BC35 96 4F		LDA	<\$4F	;Exponent
03554	BC37 A7 84		STA	,X	;...saved
03555	BC39 96 54		LDA	<\$54	;If negative, bit 7 = 1
03556	BC3B 8A 7F		ORA	#\$7F	;Mask for other bits (0-6)
03557	BC3D 94 50		ANDA	<\$50	;If negative, bit 7 = 1
03558	BC3F A7 01		STA	1,X	;MSB saved
03559	BC41 96 51		LDA	<\$51	;Next MSB
03560	BC43 A7 02		STA	2,X	
03561	BC45 DE 52		LDU	<\$52	;Least significant word saved
03562	BC47 EF 03		STU	3,X	
03563	BC49 39		RTS		

Line Number	Address	Object Code	Mnemonic	Operand	Jake's Comment
Copy FPAC2 to FPAC1					
03564	BC4A 96 61		LDA	<\$61	;Sign
03565	BC4C 97 54		STA	<\$54	
03566	BC4E 9E 5C		LDX	<\$5C	;Exponent + MSByte
03567	BC50 9F 4F		STX	<\$4F	
03568	BC52 0F 63		CLR	<\$63	;Clear carry-out byte
03569	BC54 96 5E		LDA	<\$5E	;Next MSB
03570	BC56 97 51		STA	<\$51	
03571	BC58 96 54		LDA	<\$54	;Hold sign of FPAC1
03572	BC5A 9E 5F		LDX	<\$5F	;Least Significant Word
03573	BC5C 9F 52		STX	<\$52	
03574	BC5E 39		RTS		

Line Number	Address	Object Code	Mnemonic	Operand	Jake's Comment
Copy FPAC1 to FPAC2					
03575	BC5F DC 4F		LDD	<\$4F	;Exponent + MSB
03576	BC61 DD 5C		STD	<\$5C	
03577	BC63 9E 51		LDX	<\$51	;Mid floating point
03578	BC65 9F 5E		STX	<\$5E	
03579	BC67 9E 53		LDX	<\$53	;Least significant byte + sign
03580	BC69 9F 60		STX	<\$60	
03581	BC6B 4D		TSTA		;Set flags as per exponent
03582	BC6C 39		RTS		

Line Number	Address	Object Code	Mnemonic	Operand	Jake's Comment
Get sign of FPAC1 to B					
03583	BC6D D6 4F		LDB	<\$4F	;Exponent
03584	BC6F 27 08		BEQ	\$BC79	;RTS if zero
03585	BC71 D6 54		LDB	<\$54	;Sign of FPAC1
03586	BC73 59		ROLB		;If negative, set carry
03587	BC74 C6 FF		LDB	#\$FF	;=1
03588	BC76 25 01		BLO	\$BC79	;If negative
03589	BC78 50		NEGB		;=1 if positive
03590	BC79 39		RTS		

Line Number	Address	Object Code	Mnemonic	Operand	Jake's Comment
SGN(x)					
03591	BC7A 8D F1		BSR	\$BC6D	;Get sign of FPAC1
03592	BC7C D7 50		STB	<\$50	;Save number in MSB
03593	BC7E 0F 51		CLR	<\$51	;Next MSB = 0
03594	BC80 C6 88		LDB	#\$88	;Exponent = 8 for one byte
03595	BC82 96 50		LDA	<\$50	;MSB
03596	BC84 80 80		SUBA	#\$80	;Set carry if positive
03597	BC86 D7 4F		STB	<\$4F	;Exponent
03598	BC88 DC 8A		LDD	<\$8A	;Zero constant
03599	BC8A DD 52		STD	<\$52	;Zero all LSB's and round-up
03600	BC8C 97 63		STA	<\$63	
03601	BC8E 97 54		STA	<\$54	
03602	BC90 7E BA18		JMP	\$BA18	;Floating point normalize

Line Number	Address	Object Code	Mnemonic	Operand	Jake's Comment
Clear FPAC1 mantissa					
03662	BD09 D7 50		STB	<\$50	;Zero
03663	BD0B D7 51		STB	<\$51	;to
03664	BD0D D7 52		STB	<\$52	;mantissa
03665	BD0F D7 53		STB	<\$53	;bytes
03666	BD11 39		RTS		
Convert ASCII number to FPAC1					
03667	BD12 9E 8A		LDX	<\$8A	;Literal zero
03668	BD14 9F 54		STX	<\$54	;Sign
03669	BD16 9F 4F		STX	<\$4F	;Exponent
03670	BD18 9F 51		STX	<\$51	;Mantissa
03671	BD1A 9F 52		STX	<\$52	;Mantissa LSBs
03672	BD1C 9F 47		STX	<\$47	;Scratch location
03673	BD1E 9F 45		STX	<\$45	;Scratch location
03674	BD20 25 64		BLO	\$BD86	;If "0"- "9", add to FPAC1 * 10
03675	BD22 BD 0197		JSR	\$0197	;RAM vector
03676	BD25 81 2D		CMPA	#\$2D	; "- "?
03677	BD27 26 04		BNE	\$BD2D	;No, it's positive
03678	BD29 03 55		COM	<\$55	;Flag negative
03679	BD2B 20 04		BRA	\$BD31	;Parse and continue
03680	BD2D 81 2B		CMPA	#\$2B	; "+ "?
03681	BD2F 26 04		BNE	\$BD35	;No, assume positive
03682	BD31 9D 9F		JSR	<\$9F	;Parse next char
03683	BD33 25 51		BLO	\$BD86	;If "0"- "9", add to FPAC1 * 10
03684	BD35 81 2E		CMPA	#\$2E	; ". "?
03685	BD37 27 28		BEQ	\$BD61	;If decimal point
03686	BD39 81 45		CMPA	#\$45	; "E"?
03687	BD3B 26 28		BNE	\$BD65	;Not "E", end of ASCII number
03688	BD3D 9D 9F		JSR	<\$9F	;Parse next char
03689	BD3F 25 64		BLO	\$BDA5	;If "0" - "9", build exponent
03690	BD41 81 AC		CMPA	#\$AC	; "- " token?
03691	BD43 27 0E		BEQ	\$BD53	;Yes, negative exponent
03692	BD45 81 2D		CMPA	#\$2D	; "- " character?
03693	BD47 27 0A		BEQ	\$BD53	;Yes, negative exponent
03694	BD49 81 AB		CMPA	#\$AB	; "+ " token?
03695	BD4B 27 08		BEQ	\$BD55	;Yes, positive exponent
03696	BD4D 81 2B		CMPA	#\$2B	; "+ " character?
03697	BD4F 27 04		BEQ	\$BD55	;Yes, positive exponent
03698	BD51 20 06		BRA	\$BD59	;Not "+" nor "-", positive exp
03699	BD53 03 48		COM	<\$48	;Flag negative exponent
03700	BD55 9D 9F		JSR	<\$9F	;Parse next
03701	BD57 25 4C		BLO	\$BDA5	;If "0" - "9", build exponent
03702	BD59 0D 48		TST	<\$48	;Positive exponent?
03703	BD5B 27 08		BEQ	\$BD65	;Yes, exponent done
03704	BD5D 00 47		NEG	<\$47	;Else negate the built exponent
03705	BD5F 20 04		BRA	\$BD65	;Exponent done
03706	BD61 03 46		COM	<\$46	;Flag decimal point
03707	BD63 26 CC		BNE	\$BD31	;Cont parse if this 1st dec pt
03708	BD65 96 47		LDA	<\$47	;Exponent
03709	BD67 90 45		SUBA	<\$45	;Minus # of digits after dec pt
03710	BD69 97 47		STA	<\$47	;New exponent
03711	BD6B 27 12		BEQ	\$BD7F	;Mantissa OK if exponent = 0
03712	BD6D 2A 09		BPL	\$BD78	;If postve exponent, FPAC1 * 10
03713	BD6F BD BB82		JSR	\$BB82	;FPAC1 / 10
03714	BD72 0C 47		INC	<\$47	;Exponent zero?
03715	BD74 26 F9		BNE	\$BD6F	;Continue mantissa scale if not
03716	BD76 20 07		BRA	\$BD7F	;Else mantissa OK
03717	BD78 BD BB6A		JSR	\$BB6A	;FPAC1 * 10
03718	BD7B 0A 47		DEC	<\$47	;Exponent zero?
03719	BD7D 26 F9		BNE	\$BD78	;Continue mantissa scale if not
03720	BD7F 96 55		LDA	<\$55	;Negative ASCII number?
03721	BD81 2A 8E		BPL	\$BD11	;RTS if not
03722	BD83 7E BEE9		JMP	\$BEE9	;Else negate FPAC1


```

ABS(n)
03603 BC93 0F 54      CLR    <$54      ;Set FPACl sign positive
03604 BC95 39          RTS

Compare FPACl to variable
03605 BC96 E6 84      LDB     ,X          ;Exponent of variable
03606 BC98 27 D3      BEQ     $BC6D      ;If zero do sign of FPACl
03607 BC9A E6 01      LDB     1,X        ;MSB of variable
03608 BC9C D8 54      EORB    <$54      ;If signs are different...
03609 BC9E 2B D1      BMI     $BC71      ;...use FPACl sign
03610 BCA0 D6 4F      LDB     <$4F      ;FPACl exponent
03611 BCA2 E1 84      CMPB    ,X          ;Compare exponents
03612 BCA4 26 1D      BNE     $BCC3      ;If different
03613 BCA6 E6 01      LDB     1,X        ;MSB of variable
03614 BCA8 CA 7F      ORB     #$7F      ;Ignore lower bits
03615 BCAC D4 50      ANDB    <$50      ;AND MSB of FPACl
03616 BCAC E1 01      CMPB    1,X        ;Same as variable?
03617 BCAC 26 13      BNE     $BCC3      ;No, compare done
03618 BCB0 D6 51      LDB     <$51      ;Next MSBs the same?
03619 BCB2 E1 02      CMPB    2,X        ;
03620 BCB4 26 0D      BNE     $BCC3      ;No, compare done
03621 BCB6 D6 52      LDB     <$52      ;Next LSBs the same?
03622 BCB8 E1 03      CMPB    3,X        ;
03623 BCBA 26 07      BNE     $BCC3      ;No, compare done
03624 BCB4 D6 53      LDB     <$53      ;LSBs the same?
03625 BCBE E0 04      SUBB    4,X        ;
03626 BCC0 26 01      BNE     $BCC3      ;No, compare done
03627 BCC2 39          RTS              ;Zero flag set. FPACl =variable
03628 BCC3 56          RORB                     ;Carry Flag to register B
03629 BCC4 D8 54      EORB    <$54      ;Adjust result by sign of FPACl
03630 BCC6 20 AB      BRA     $BC73      ;Do sign of difference

FPACl to integer
03631 BCC8 D6 4F      LDB     <$4F      ;Exponent
03632 BCCA 27 3D      BEQ     $BD09      ;If zero, Reset FPACl to zero
03633 BCCC C0 A0      SUBB    $A0          ;Exponent minus 32
03634 BCCE 96 54      LDA     <$54      ;Sign of FPACl
03635 BCD0 2A 05      BPL     $BCD7      ;If positive
03636 BCD2 03 5B      COM     <$5B      ;Negate the carry-in byte
03637 BCD4 BD BA7B     JSR     $BA7B      ;Complement FPACl
03638 BCD7 8E 004F     LDX     #$004F      ;=> FPACl
03639 BCDA C1 F8      CMPB    $F8          ;Less than 8 bits to shift?
03640 BCDC 2E 06      BGT     $BCE4      ;Yes
03641 BCDE BD BAAE     JSR     $BAAE      ;Start shifting Byte by Byte
03642 BCE1 0F 5B      CLR     <$5B      ;Reset the carry-in byte
03643 BCE3 39          RTS
03644 BCE4 0F 5B      CLR     <$5B      ;Reset the carry-in byte
03645 BCE6 96 54      LDA     <$54      ;Sign in bit 7 ...
03646 BCE8 49          ROLA                     ;... to the carry flag
03647 BCE9 06 50      ROR     <$50      ;Into MSB mantissa
03648 BCEB 7E BABA     JMP     $BABA      ;Shift mantissa right (-B) bits

INT(FPACl)
03649 BCEE D6 4F      LDB     <$4F      ;Exponent
03650 BCF0 C1 A0      CMPB    $A0          ;Exponent > 32?
03651 BCF2 24 1D      BHS     $BD11      ;RTS if no fractional part
03652 BCF4 8D D2      BSR     $BCC8      ;Floating point to integer
03653 BCF6 D7 63      STB     <$63      ;Zero carry-out byte
03654 BCF8 96 54      LDA     <$54      ;Sign of FPACl
03655 BCFA D7 54      STB     <$54      ;Zero the sign
03656 BCFC 80 80      SUBA    $80          ;Set carry flag as per sign
03657 BCFE 86 A0      LDA     $A0          ;Set binary point to 32 ...
03658 BD00 97 4F      STA     <$4F      ;...to exponent
03659 BD02 96 53      LDA     <$53      ;Save LSB
03660 BD04 97 01      STA     <1
03661 BD06 7E BA18     JMP     $BA18      ;Floating point normalize

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Add ASCII # to FPACl * 10
03723 BD86 D6 45      LDB     <$45      ;Current # digits after dec pt
03724 BD88 D0 46      SUBB    <$46      ;Bump if dec point encountered
03725 BD8A D7 45      STB     <$45      ;New # of digits after dec pt
03726 BD8C 34 02      PSHS    A          ;Save ASCII character number
03727 BD8E BD BB6A     JSR     $BB6A      ;FPACl * 10
03728 BD91 35 04      PULS    B          ;Convert ASCII # ...
03729 BD93 C0 30      SUBB    #$30      ;...to integer byte
03730 BD95 8D 02      BSR     $BD99      ;FPACl = FPACl + B
03731 BD97 20 98      BRA     $BD31      ;Next ASCII character

Add B to FPACl
03732 BD99 BD BC2F     JSR     $BC2F      ;FPACl to scratch at <$40
03733 BD9C BD BC7C     JSR     $BC7C      ;Convert byte to F.P. in FPACl
03734 BD9F 8E 0040     LDX     #$0040      ;=> Scratch
03735 BDA2 7E B9C2     JMP     $B9C2      ;FPACl = FPACl + scratch

Build ASCII exponent in <$47
03736 BDA5 D6 47      LDB     <$47      ;ASCII exponent
03737 BDA7 58          ASLB                     ;Times two
03738 BDA8 58          ASLB                     ;Times four
03739 BDA9 DB 47      ADDB    <$47      ;Times five
03740 BDAB 58          ASLB                     ;Times ten
03741 BDAC 80 30      SUBA    #$30      ;ASCII to integer in A
03742 BDAD 34 04      PSHS    B          ;Add A + B
03743 BDAE AB E0      ADDA    ,S+
03744 BDB2 97 47      STA     <$47      ;Update exponent
03745 BDB4 20 9F      BRA     $BD55      ;Continue building exponent

03746 BDB6 9B 3E      ADDA    <$3E      ;Floating point
03747 BDB8 BC 1FFD     CMPX    $1FFD      ;literal 99,999,999.9
03748 BDBB 9E 6E      LDX     <$6E      ;Floating point
03749 BDBD 6B          LDB                     ;literal
03750 BDBE 27 FD      BEQ     $BDBD      ;999,999,999
03751 BDC0 9E 6E      LDX     <$6E      ;Floating point
03752 BDC2 6B          LDB                     ;literal
03753 BDC3 28 00      BVC     $BDC5      ;1 E 09

Convert integer to ASCII & print it
03754 BDC5 8E ABE7     LDX     $ABE7      ;=> " IN "
03755 BDC8 8D 0C      BSR     $BDD6      ;Print " IN "
03756 BDCA DC 68      LDD     <$68      ;Line number
03757 BDCC DD 50      STD     <$50      ;Save line number as integer
03758 BDCE C6 90      LDB     #$90      ;Exponent = 16
03759 BDD0 43          COMA                     ;Set carry flag to force pos.
03760 BDD1 BD BC86     JSR     $BC86      ;Convert to Floating Point
03761 BDD4 8D 03      BSR     $BDD9      ;Convert to ASCII
03762 BDD6 7E B99C     JMP     $B99C      ;Print message

Convert FPACl to ASCII
03763 BDD9 CE 03DA     LDU     #$03DA      ;ASCII number buffer
03764 BDDC 86 20      LDA     $20          ;Default prefix = " "
03765 BDE0 D6 54      LDB     <$54      ;Sign of number
03766 BDE2 2A 02      BPL     $BDE4      ;If positive
03767 BDE4 86 2D      LDA     $2D          ;Else sign is "-"
03768 BDE6 A7 C0      STA     ,U+         ;Place sign prefix in buffer
03769 BDE8 DF 64      STU     <$64      ;Hold buffer position
03770 BDEA 97 54      STA     <$54      ;Hold prefix character
03771 BDEC 86 30      LDA     $30          ;ASCII zero in case FPACl = 0
03772 BDEC D6 4F      LDB     <$4F      ;Exponent = 0?
03773 BDEE 1027 00C6    LBEQ    $BEB8      ;Return "0" if so
03774 BDF2 4F          CLRA                     ;Initlz # of digits aftr dec pt
03775 BDF3 C1 80      CMPB    $80          ;Exponent
03776 BDF5 22 08      BHI     $BDF5      ;If number >= 1
03777 BDF7 8E BDC0     LDX     $BDC0      ;=> floating point # 1.E+09
03778 BDF9 BD BACA     JSR     $BACA      ;F.P. multiply FPACl * 1.E+09

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more

Line Number	Address	Object Code	Mnemonic	Operand	Jake's Comment
03779	BDFD 86 F7		LDA	#\$F7	;9 digits req'd to adjst dec pt
03780	BDFE 97 45		STA	<\$45	;Number of digits after dec pt
03781	BE01 8E BDBB		LDX	#\$BDBB	;=> floatng point nr 999999999
03782	BE04 BD BCA0		JSR	\$BCA0	;Compare FPAC1 to 999999999
03783	BE07 2E 0F		BGT	\$BE18	;If FPAC1 is bigger
03784	BE09 8E BDB6		LDX	#\$BDB6	;=> floatng point nr 99999999.9
03785	BE0C BD BCA0		JSR	\$BCA0	;Compare FPAC1 to 99999999.9
03786	BE0F 2E 0E		BGT	\$BE1F	;If FPAC1 is bigger
03787	BE11 BD BB6A		JSR	\$BB6A	;FPAC1 * 10
03788	BE14 0A 45		DEC	<\$45	;Move dec pnt one place back
03789	BE16 20 F1		BRA	\$BE09	
03790	BE18 BD BB82		JSR	\$BB82	;Divide FPAC1 by ten
03791	BE1B 0C 45		INC	<\$45	;Move dec pnt 1 place forward
03792	BE1D 20 E2		BRA	\$BE01	
03793	BE1F BD B9B4		JSR	\$B9B4	;FPAC1 + .5
03794	BE22 BD BCC8		JSR	\$BCC8	;FPAC1 to integer
03795	BE25 C6 01		LDB	#1	;Default # digits after dec pt
03796	BE27 96 45		LDA	<\$45	;# digits to adjust dec pt
03797	BE29 8B 0A		ADDA	#\$0A	;Dec pnt fits within FPAC1?
03798	BE2B 2B 09		BMI	\$BE36	;If > 9 zeros after dec pt
03799	BE2D 81 0B		CMPA	#\$0B	; > 10 characters before dec pt?
03800	BE2F 24 05		BHS	\$BE36	;Yes, setup decimal exponent
03801	BE31 4A		DECA		;Adjust # chars before dec pt
03802	BE32 1F 89		TFR	A,B	;Into B
03803	BE34 86 02		LDA	#2	;Decimal exponent not needed
03804	BE36 4A		DECA		;Adjust...
03805	BE37 4A		DECA		;...decimal exponent
03806	BE38 97 47		STA	<\$47	;Save decimal Exponent
03807	BE3A D7 45		STB	<\$45	;# of chars before dec pt
03808	BE3C 2E 0D		BGT	\$BE4B	;If chars needed before dec pt
03809	BE3E DE 64		LDU	<\$64	;Current ASCII buffer position
03810	BE40 86 2E		LDA	#\$2E	;". "
03811	BE42 A7 C0		STA	,U+	;Decimal point to buffer
03812	BE44 5D		TSTB		;Any zeros after decimal point?
03813	BE45 27 04		BEQ	\$BE4B	;If not
03814	BE47 86 30		LDA	#\$30	;ASCII zero
03815	BE49 A7 C0		STA	,U+	;To buffer
03816	BE4B 8E BEC5		LDX	#\$BEC5	;=> Conversion list
03817	BE4E C6 80		LDB	#\$80	;Initialize exponent
03818	BE50 96 53		LDA	<\$53	;LSB
03819	BE52 AB 03		ADDA	3,X	
03820	BE54 97 53		STA	<\$53	
03821	BE56 96 52		LDA	<\$52	;Next LSB
03822	BE58 A9 02		ADCA	2,X	
03823	BE5A 97 52		STA	<\$52	
03824	BE5C 96 51		LDA	<\$51	;Next MSB
03825	BE5E A9 01		ADCA	1,X	
03826	BE60 97 51		STA	<\$51	
03827	BE62 96 50		LDA	<\$50	;MSB
03828	BE64 A9 84		ADCA	,X	
03829	BE66 97 50		STA	<\$50	
03830	BE68 5C		INCB		;Bump # of subtrctns/additns
03831	BE69 56		RORB		;Adjust to test for overflow
03832	BE6A 59		ROLB		;Check if went too far
03833	BE6B 28 E3		BVC	\$BE50	;If no overflow, do another
03834	BE6D 24 03		BHS	\$BE72	;If subtrctng, this time around
03835	BE6F C0 0B		SUBB	#\$0B	;Else B is one too far negative
03836	BE71 50		NEGB		;Adjust B (1-A)
03837	BE72 CB 2F		ADDB	#\$2F	;Cvrt to ASCII #-went 1 too far
03838	BE74 30 04		LEAX	4,X	;=> next in list
03839	BE76 1F 98		TFR	B,A	;ASCII digit to A
03840	BE78 84 7F		ANDA	#\$7F	;Remove possible high bit
03841	BE7A A7 C0		STA	,U+	;To buffer
03842	BE7C 0A 45		DEC	<\$45	;1 less digit before dec pt
03843	BE7E 26 04		BNE	\$BE84	;If not at decimal point

Line Number	Address	Object Code	Mnemonic	Operand	Jake's Comment
Do required number in series					
03905	BEFF 9F 64		STX	<\$64	;Save pointer
03906	BF01 BD BC2A		JSR	\$BC2A	;FPAC1 = FPAC1 + scratch1
03907	BF04 9E 64		LDX	<\$64	;Restore pointer
03908	BF06 E6 80		LDB	,X+	;Number of iterations to B
03909	BF08 D7 55		STB	<\$55	;Save as a loop counter
03910	BF0A 9F 64		STX	<\$64	;Save pointer
03911	BF0C 8D EE		BSR	\$BEFC	;F. P. multiply scratch1 * FPAC1
03912	BF0E 9E 64		LDX	<\$64	;Restore pointer
03913	BF10 30 05		LEAX	5,X	;Bump to next in table
03914	BF12 9F 64		STX	<\$64	;Save pointer
03915	BF14 BD B9C2		JSR	\$B9C2	;FPAC1 + table entry
03916	BF17 8E 0045		LDX	#\$0045	;=> scratch2
03917	BF1A 0A 55		DEC	<\$55	;More to do?
03918	BF1C 26 EE		BNE	\$BF0C	;If so
03919	BF1E 39		RTS		
RND(x)					
03920	BF1F BD BC6D		JSR	\$BC6D	;Sign to B
03921	BF22 2B 21		BMI	\$BF45	;If negative
03922	BF24 27 15		BEQ	\$BF3B	;If zero
03923	BF26 8D 10		BSR	\$BF38	;If > 0 do INT(x)
03924	BF28 BD BC2F		JSR	\$BC2F	;Copy FPAC1 to scratch1
03925	BF2B 8D 0E		BSR	\$BF3B	;Get RND(0)
03926	BF2D 8E 0040		LDX	#\$0040	;=> random number range
03927	BF30 8D CA		BSR	\$BEFC	;F. P. multiply scratch1 * FPAC1
03928	BF32 8E BAC5		LDX	#\$BAC5	;=> F. P. # 1.0
03929	BF35 BD B9C2		JSR	\$B9C2	;Add 1.0 to number
03930	BF38 7E BCEE		JMP	\$BCEE	;INT(x)
RND(0)					
03931	BF3B BE 0116		LDX	\$0116	;Current seed to FPAC1
03932	BF3E 9F 50		STX	<\$50	
03933	BF40 BE 0118		LDX	\$0118	
03934	BF43 9F 52		STX	<\$52	
03935	BF45 BE BF74		LDX	\$BF74	;Set up FPAC2
03936	BF48 9F 5D		STX	<\$5D	
03937	BF4A BE BF76		LDX	\$BF76	
03938	BF4D 9F 5F		STX	<\$5F	
03939	BF4F BD BAD0		JSR	\$BAD0	;Multiply
03940	BF52 DC AD		LDD	<\$AD	;Last truncated by F.P. multiply
03941	BF54 C3 658B		ADDD	#\$658B	
03942	BF57 FD 0118		STD	\$0118	;New seed
03943	BF5A DD 52		STD	<\$52	;Into Least Signfcnt Word FPAC1
03944	BF5C DC AB		LDD	<\$AB	;Last truncatd by F.P. multiply
03945	BF5E C9 B0		ADCB	#\$B0	
03946	BF60 89 05		ADCA	#5	;Form new seed
03947	BF62 FD 0116		STD	\$0116	;Store new seed
03948	BF65 DD 50		STD	<\$50	;FPAC1
03949	BF67 0F 54		CLR	<\$54	;Set sign positive
03950	BF69 86 80		LDA	#\$80	;Set 0 < RND# < 1
03951	BF6B 97 4F		STA	<\$4F	
03952	BF6D 96 15		LDA	<\$15	;FPAC3 next LSB
03953	BF6F 97 63		STA	<\$63	;Becomes FPAC2 F.P. excess
03954	BF71 7E BAlC		JMP	\$BAlC	;Normalize
03955	BF74 40		NEGA		
03956	BF75 E6 4D		LDB	\$0D,U	
03957	BF77 AB BDBC5F		ADDA	(-43A,PC)	
SIN(n)					
-----	BF78 BD BC5F		JSR	\$BC5F	;Copy FPAC1 to FPAC2
03958	BF7B 8E BFBD		LDX	#\$BFBD	;=> 6.28 (2 pi)
03959	BF7E D6 61		LDB	<\$61	;Sign of FPAC2


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03844 BE80 86 2E      LDA  #2E      ;Else decimal point...
03845 BE82 A7 C0      STA  ,U+      ;...to buffer
03846 BE84 53          COMB          ;Rvrs hi bit,chk oppst ovrflw
03847 BE85 C4 80      ANDB  #80      ;Extract high bit
03848 BE87 8C BEE9    CMPX  #BEE9    ;At the end of the list?
03849 BE8A 26 C4      BNE  $BE50    ;Continue until done
03850 BE8C A6 C2      LDA  , -U      ;Get next character back
03851 BE8E 81 30      CMPA  #30      ;ASCII zero?
03852 BE90 27 FA      BEQ  $BE8C    ;Yes, backup until not "0"
03853 BE92 81 2E      CMPA  #2E      ;Dec pt before trailing zeros?
03854 BE94 26 02      BNE  $BE98    ;If not
03855 BE96 33 5F      LEAU  -1,U      ;Else backup over dec pt
03856 BE98 86 2B      LDA  #2B      ;"+" for possible dcml exponent
03857 BE9A D6 47      LDB  <$47      ;"E" exponent number
03858 BE9C 27 1C      BEQ  $BEBA    ;Out if no dcml exponent req'd
03859 BE9E 2A 03      BPL  $BEA3    ;If positive decimal exponent
03860 BEA0 86 2D      LDA  #2D      ; "-"
03861 BEA2 50          NEGB          ;Cnvr exponent to postve nmbr
03862 BEA3 A7 42      STA  2,U      ;Exponent sign
03863 BEA5 86 45      LDA  #45      ;"E"
03864 BEA7 A7 41      STA  1,U      ;Save decimal exponent "E"
03865 BEA9 86 2F      LDA  #2F      ;Initialize ASCII number
03866 BEAB 4C          INCA          ;Build tens digit in A
03867 BEAC C0 0A      SUBB  #0A      ;minus ten
03868 BEAE 24 FB      BHS  $BEAB    ;Make B the ASCII units digit
03869 BEB0 CB 3A      ADDB  #3A      ;ASCII dcml exponent to buffer
03870 BEB2 ED 43      STD  3,U      ;Delimit
03871 BEB4 6F 45      CLR  5,U      ;
03872 BEB6 20 04      BRA  $BEBC    ;
03873 BEB8 A7 C4      STA  ,U      ;If variable = 0 only
03874 BEBA 6F 41      CLR  1,U      ;Delimit string
03875 BEBC 8E 03DA    LDX  #03DA    ;=> ASCII string
03876 BEBF 39          RTS

```

Floating point constants

```

03877 BEC0 80 00      SUBA  #0      ;0.5
03878 BEC2 00 00      NEG  <0      ;
03879 BEC4 00 FA      NEG  <$FA      ;F.P. conversion constants
03880 BEC6 0A 1F      DEC  <$1F      ;
03881 BEC8 00 00      NEG  <0      ;
03882 BECA 98 96      EORA  <$96      ;
03883 BECC 80 FF      SUBA  #FF      ;
03884 BECE F0 BDC0     SUBB  $BDC0     ;
03885 BED1 00 01      NEG  <1      ;
03886 BED3 86 A0      LDA  #A0      ;
03887 BED5 FF FFD8     STU  $FFD8     ;
03888 BED8 F0 0000     SUBB  0      ;
03889 BEDB 03 E8      COM  <$E8      ;
03890 BEDD FF FFFF     STU  $FFFF     ;
03891 BEE0 9C 00      CMPX  <0      ;
03892 BEE2 00 00      NEG  <0      ;
03893 BEE4 0A FF      DEC  <$FF      ;
03894 BEE6 FF FFFF     STU  $FFFF     ;

```

Negate FPAC1

```

03895 BEE9 96 4F      LDA  <$4F      ;Exponent FPAC1
03896 BEEB 27 02      BEQ  $BEEF      ;RTS if zero
03897 BEED 03 54      COM  <$54      ;Else reverse sign of FPAC1
03898 BEEF 39          RTS

```

Summation

```

03899 BEF0 9F 64      STX  <$64      ;Save pointer to series table
03900 BEF2 BD BC2F     JSR  $BC2F      ;FPAC1 to scratch1 at 0040
03901 BEF5 8D 05      BSR  $BEFC      ;F. P. multiply scratch1 * FPAC1
03902 BEF7 8D 08      BSR  $BF01      ;Do required # iterations
03903 BEF9 8E 0040     LDX  #0040      ;=> Scratch1
03904 BEFC 7E BACA      JMP  $BACA      ;F. P. multiply scratch1 * FPAC1

```

```

03960 BF80 BD BB89    JSR  $BB89      ;n divided by 2 pi
03961 BF83 BD BC5F    JSR  $BC5F      ;Copy FPAC1 to FPAC2
03962 BF86 8D B0      BSR  $BF38      ;INT(n/2pi) to FPAC1
03963 BF88 0F 62      CLR  <$62      ;Set sign of result positive
03964 BF8A 96 5C      LDA  <$5C      ;(n/2 pi) exponent
03965 BF8C D6 4F      LDB  <$4F      ;INT (n/2 pi) exponent
03966 BF8E BD B9BC    JSR  $B9BC      ;F. P. subtract
03967 BF91 8E BFC2    LDX  #BFC2      ;=> 0.25
03968 BF94 BD B9B9    JSR  $B9B9      ;F.P. subtract
03969 BF97 96 54      LDA  <$54      ;FPAC1 sign
03970 BF99 34 02      PSHS  A      ;Save it
03971 BF9B 2A 09      BPL  $BFA6      ;If positive
03972 BF9D BD B9B4    JSR  $B9B4      ;FPAC1 + 0.5
03973 BFA0 96 54      LDA  <$54      ;Sign of FPAC1
03974 BFA2 2B 05      BMI  $BFA9      ;If negative
03975 BFA4 03 0A      COM  <$0A      ;
03976 BFA6 BD BEE9    JSR  $BEE9      ;Negate FPAC1
03977 BFA9 8E BFC2    LDX  #BFC2      ;=> 0.25
03978 BFAC BD B9C2    JSR  $B9C2      ;FPAC1 + 0.25
03979 BFAF 35 02      PULS  A      ;FPAC1 sign
03980 BFB1 4D          TSTA          ;Positive?
03981 BFB2 2A 03      BPL  $BFB7      ;If so
03982 BFB4 BD BEE9    JSR  $BEE9      ;Else negate FPAC1
03983 BFB7 8E BFC7    LDX  #BFC7      ;=> SIN coefficient table
03984 BFBA 7E BEF0     JMP  $BEF0      ;Compute series and RTS

```

SIN Constants

```

03985 BFBD 83 490F    SUBD  #490F      ; 6.28 (2 pi)
03986 BFC0 DA A2      ORB  <$A2      ;
03987 BFC2 7F 0000    CLR  0      ; 0.25
03988 BFC5 00 00      NEG  <0      ;

```

SIN Coefficient table

```

03989 BFC7 05          ;Number of entries in table
03990 BFC8 84 E6      ANDA  #E6
03991 BFCA 1A 2D      ORCC  #2D
03992 BFCC 1B          ;
03993 BFCD 86 28      LDA  #28
03994 BFCF 07 FB      ASR  <$FB
03995 BFD1 F8 8799     EORB  $8799
03996 BFD4 68 890187  ASL  $0187,X
03997 BFD8 23 35      BLS  $C00F
03998 BFDA DF E1      STU  <$E1
03999 BFDC 86 A5      LDA  #A5
04000 BFDE 5D          TSTB
04001 BFDF E7 28      STB  8,Y
04002 BFE1 83 490F    SUBD  #490F
04003 BFE4 DA A2      ORB  <$A2
04004 BFE6 A1 54      CMPA  -$0C,U
04005 BFE8 46          RORA
04006 BFE9 8F          ;
04007 BFEA 13          SYNC
04008 BFEB 8F          ;
04009 BFEC 52          ;
04010 BFED 43          COMA
04011 BFEE 89 CD      ADCA  #CD
04012 BFF0 A6 81      LDA  ,X++
04013 BFF2 01          ;
04014 BFF3 00 01      NEG  <1
04015 BFF5 03 01      COM  <1
04016 BFF7 0F 01      CLR  <1
04017 BFF9 0C 01      INC  <1
04018 BFFB 06 01      ROR  <1
04019 BFFD 09 A0      ROL  <$A0
04020 BFFF 27 7E      BEQ  $C07F

```


3-D GRAPHICS!

Finally!

Real Graphics!

I WANTED A PROGRAM which could easily read a data file from tape so I could produce several graphics representations without changing data statements in a program, could rotate an object about more than one axis at a time, could change distance from the object (a zoom lens effect), and could display a continuous rotation without stopping to calculate between each position. The program should also have a fast, smooth display, and be easy to operate. I also wanted hidden line removal, but found the memory limitations (both the computer's and mine) to fall short of the goal.

I wrote a program that would meet my requirements. This program reads a data file from tape, and then calculates and displays an object. To get the data file on tape, I wrote a drawing editor. I was surprised to find that it was about twice as long as the rotation program after I included everything I needed in the editor. To use the editor, we must define an object as a list of three-dimensional line coordinates.

Defining 3-D Objects

An easy way to define the coordinates of a three-dimensional object is to draw side, front, and top views of the object on graph paper, then make a list of the X, Y, and Z coordinates of the two endpoints of each line in the object.

For example, let's define the coordinates of a simple object: a cabin. First draw the side, front, and top views of the cabin on graph paper (see Figure 1). Then list coordinates along the edges of the

by Dale A. Keller

graph paper, counting from 0, 0, 0 in the very center of the cabin. Next label the X axis along the length of the cabin, the Y

axis across the width, and label the Z axis vertically.

We are now ready to make our list. We can start with any line, but we must keep track of those we have finished. Do this by numbering each line or working from one end of the object to the other. For this demonstration, I have numbered the lines. For the line numbered one, the coor-

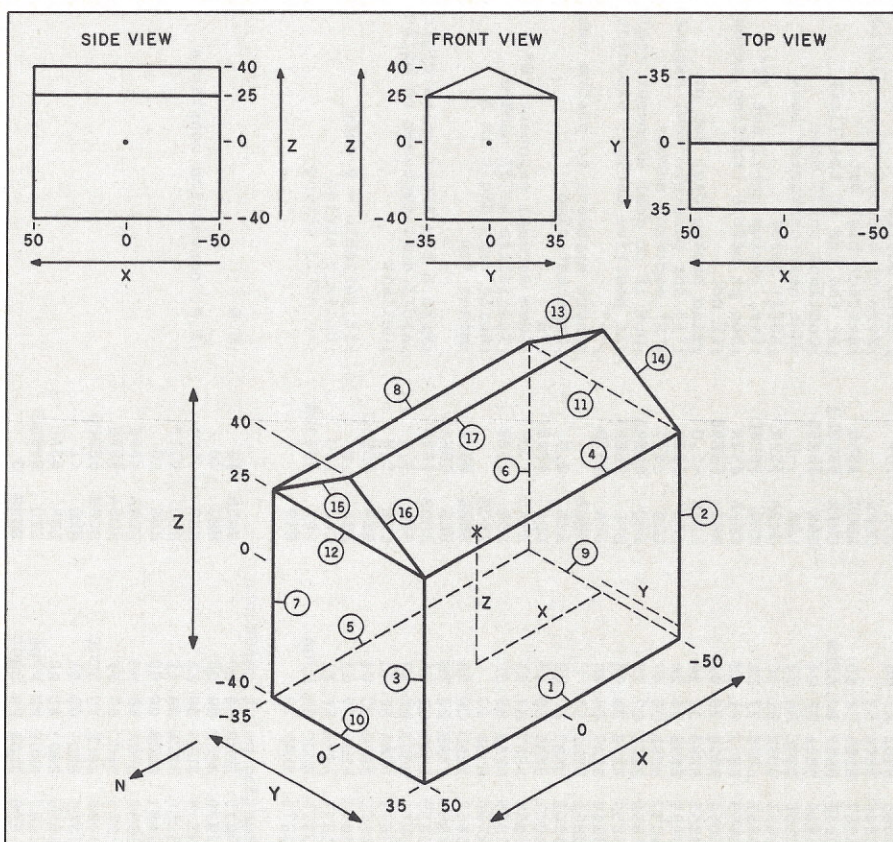
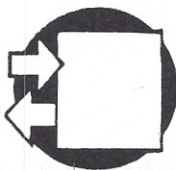


Figure 1. Defining Cabin Coordinates



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dinates are: X = 50, Y = 35, Z = -40 to X = -50, Y = 35, Z = -40. Continue the list until both end coordinates of all the lines have been defined (see Figure 2). On complex objects, it also helps to label the lines in the list (for instance, lines 1 through 4 are the west wall).

Using the Editor

Now our object has been defined as a set of coordinates, we must make a tape file of this list. Type in and CSAVE Program Listing 1. Then type: PCLEAR1: CLEAR 20,16383. This clears the graphics memory for use by Basic, and sets the upper limit of memory to 16383 bytes. If you try to run the program without first entering these commands, Basic will execute the first line and then stop. Running the program again will work fine.

The first screen you will see is the main menu. Since we are entering a new picture, hit 1 and Enter. Now you can enter the coordinates from Figure 2, first typing the first three numbers (in the From column) separated by commas, hitting Enter, then the second three numbers (in the To column) separated by commas. When all the lines have been entered, hit 999 followed by two commas, and Enter. This tells the editor you are finished entering new lines and it will return to the main menu.

To check your entries, hit 2, for Edit. When the Edit menu appears, hit 4 for List. Check each entry carefully, writing down any line numbers in error. If you need to make any corrections when the Edit menu reappears, hit the appropriate number and the line number if needed. Lines are changed or added one at a time by typing the correct coordinates.

When you have a correct listing, return to the main menu (hit 5). Now hit 3 to save your listing to tape. The screen will say WORKING.... Don't panic, it is not saving yet. It is storing the data in high memory, from where it will CSAVE the program. When the computer is ready, it will ask for a drawing name. Enter any appropriate name (for instance: CABIN). When it is finished saving, return to the main menu and load the file you just saved. List it and check that everything is correct.

Displaying an Object

Type in and CSAVE Program Listing 2. Then type: PCLEAR8: CLEAR 10,16383. If you run this program without first entering these commands, the program will run until just before the display and then quit.

The program first loads your data file from tape into high memory (Lines 40 -

Line No.	From			To			
	X	Y	Z	X	Y	Z	
1	50,	35,	-40	-50,	35,	-40	West Wall
2	-50,	35,	-40	-50,	35,	25	
3	50,	35,	-40	50,	35,	25	
4	50,	35,	25	-50,	35,	25	
5	50,	-35,	-40	-50,	-35,	-40	East Wall
6	-50,	-35,	-40	-50,	-35,	25	
7	50,	-35,	-40	50,	-35,	25	
8	50,	-35,	25	-50,	-35,	25	
9	-50,	35,	-40	-50,	-35,	-40	Ends
10	50,	35,	-40	50,	-35,	-40	
11	-50,	35,	25	-50,	-35,	25	
12	50,	35,	25	50,	-35,	25	
13	-50,	-35,	25	-50,	0,	40	Roof
14	-50,	35,	25	-50,	0,	40	
15	50,	-35,	25	50,	0,	40	
16	50,	35,	25	50,	0,	40	
17	-50,	0,	40	50,	0,	40	

Figure 2. Line List For the Cabin

80). It then finds how many lines are in the object (variable LC for Line Count) and tells you how many steps you may have according to memory limits (Line 90). See Figure 3 for typical number of steps.

Line 110 asks for the position for the starting view of the object. The distance is your distance from the object. The angle around is your horizontal angle in degrees from the X axis. The elevation angle is your vertical angle in degrees from the Z axis (see Figure 4). The first time through (with the cabin drawing) use a distance 1 of 3000, and angle around 1 of 90 degrees, an elevation angle 1 of 75 degrees, a distance 2 of 1500, an angle around 2 of 160 degrees, and an elevation angle 2 of 45 degrees. Line 150 asks for the number of steps. For the first time try only five steps.

Lines 160 through 320 get the coordi-

Lines	Steps Available	Computing Time (for 14 steps)
256	14	16.5 minutes
128	28	8.25 minutes
64	57	248 seconds
32	115	124 seconds
17	218	67 seconds

Figure 3. Time and Steps

nates of the object from high memory (addresses 16385 - 17920) and calculate their positions for each of your points of view. This data is stored in high memory (addresses 17921 - 32767). This process is very slow since the computer has to handle so many numbers. To calculate five positions for the 17 lines in the cabin it will take about 25 seconds. For more complex objects this can take up to 16½ minutes.

Program Listing 1. 3D Editor

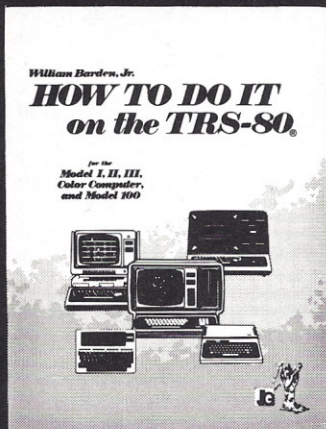
```

10 CLEAR20,16383:PCLEAR1
20 '3D EDITOR by Dale A. Keller
40 DIM A(1536)
50 CLS:PRINT"NEW PICTURE (1)":PR
INT"EDIT OLD PICTURE (2)":PRINT"
SAVE (3)":PRINT"LOAD (4)":INPUT
A
60 ON A GOTO 80,210,650,800
70 GOTO 50
80 'DRAW NEW PICTURE
90 CLS:PRINT"NEW PICTURE":PRINT"
HIT 999 TO EXIT":PRINT

```

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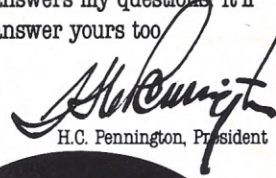
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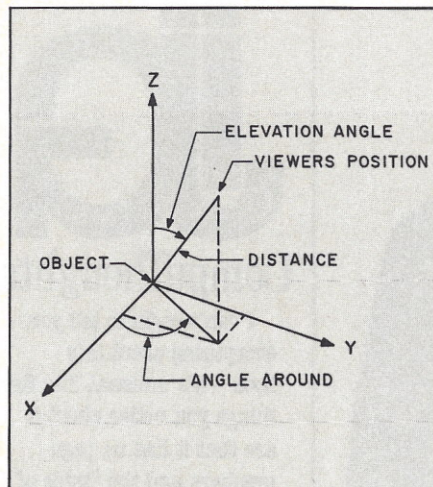


Figure 4. Angle and Distance Measurements

When the computing is finished, the computer will ask if you are ready and play a short tune (make sure the volume is turned up on the TV so you can hear it from the refrigerator. Like I said, some of these rotations take a long time to compute).

Lines 330 and on draw the displays on alternating screens. For simple objects this is a fairly quick process. Complex objects are slower, but you still appear to be moving around the object. When the display stops, hitting any key will take you to a short menu in Line 470. The rotation can be viewed again immediately since it has already been figured, or you can rotate the same object through different angles.

There are some limitations to this program. You may only use up to 256 lines. The object should be centered on the coordinates 0, 0, 0 to rotate smoothly on its center. Lines must have coordinates in the range of -128 to 127. There is no line clipping routine, so lines must be within the graphics screen dimensions. If you use too short a distance, values of less than 0 or greater than 255 will be computed and the computer will try to POKE them somewhere, resulting in a Function Call Error. Using a greater distance will remedy this error.

The variable SC in Line 20 is a scale value. This compensates for the screen aspect ratio (256 by 192 pixels) and your TV aspect ratio (approximately 4 to 3). This should be changed to fit your TV. To do this, type in Listing 3 and run the program. Then measure the width and height of the square with a ruler. Use the formula $SV = \text{height/width}$ to find SV.

When you get tired of the Cabin, try some other objects — cubes, pyramids, etc. Try rotating two objects around each other. Figure 5 is the coordinate list for a

Figure 5. Line List For a Space Shuttle

Line Number	From			To			Description
1	-44,	0,	14	55,	0,	15	Split Between Doors
2	55,	0,	15	60,	0,	10	Top Center Over Windows
3	60,	0,	10	83,	0,	0	Nose (center)
4	83,	0,	0	86,	0,	-3	
5	86,	0,	-3	85,	0,	-6	
6	85,	0,	-6	77,	0,	-10	
7	77,	0,	-10	45,	0,	-12	
8	-44,	0,	14	-45,	0,	19	Tail
9	-45,	0,	19	-82,	0,	-52	
10	-82,	0,	52	-92,	0,	52	
11	-92,	0,	52	-94,	0,	51	
12	-94,	0,	51	-80,	0,	22	
13	-80,	0,	22	-70,	0,	18	Right Wing
14	-68,	-16,	-13	-61,	-58,	-9	
15	-61,	-58,	-9	-54,	-58,	-9	
16	-54,	-58,	-9	-42,	-56,	-10	
17	-42,	-56,	-10	-13,	-26,	-12	
18	-13,	-26,	-12	47,	-13,	-10	Left Wing
19	-68,	16,	-13	-61,	58,	-9	
20	-61,	58,	-9	-54,	58,	-9	
21	-54,	58,	-9	-42,	55,	-10	
22	-42,	55,	-10	-13,	27,	-12	
23	-13,	27,	-12	47,	13,	-10	Front Body Arch
24	45,	-13,	-14	45,	-13,	9	
25	45,	-13,	9	45,	-9,	13	
26	45,	-9,	13	45,	-4,	15	
27	45,	-4,	15	45,	4,	15	
28	45,	4,	15	45,	9,	13	Rear Body Arch
29	45,	9,	13	45,	13,	9	
30	45,	13,	9	45,	13,	-14	
31	-45,	-13,	-14	-45,	-13,	9	
32	-45,	-13,	9	-45,	-9,	13	
33	-45,	-9,	13	-45,	-4,	15	Left Side of Nose
34	-45,	-4,	15	-45,	4,	15	
35	-45,	4,	15	-45,	9,	13	
36	-45,	9,	13	-45,	13,	9	
37	-45,	13,	9	-45,	13,	-14	
38	45,	13,	-4	48,	13,	-4	Right Side of Nose
39	48,	13,	-4	78,	7,	-4	
40	78,	7,	-4	85,	3,	-4	
41	85,	3,	-4	86,	0,	-4	Left Wing To Body Joint
42	45,	-13,	-4	48,	-13,	-4	
43	48,	-13,	-4	78,	-7,	-4	
44	78,	-7,	-4	85,	-3,	-4	Right Wing To Body Joint
45	85,	-3,	-4	86,	0,	-4	
46	45,	13,	-12	-42,	13,	-15	
47	-42,	13,	-15	-72,	13,	-14	Front Lower Body
48	45,	-13,	-12	-42,	-13,	-15	
49	-42,	-13,	-15	-72,	-13,	-14	
50	45,	13,	-12	45,	-13,	-12	Rear Lower Body
51	-72,	13,	-14	-72,	-13,	-14	
52	-72,	14,	-14	-84,	14,	-13	
53	-84,	14,	-13	-72,	14,	-12	Left Side Rear Flap
54	-72,	-14,	-14	-84,	-14,	-13	
55	-84,	-14,	-13	-72,	-14,	-12	
56	-84,	14,	-13	-84,	-14,	-13	Rear Edge Of Flap

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The most powerful and easy-to-use word processor is available in the showpiece and workhorse of the **Library: The VIP Writer™**. Because of its undisputed superiority over all Color Computer word processors, it was selected by Dragon Data Ltd. of England and TANO in the U.S., to be the Official Word Processor for their line of Dragon microcomputers.

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Although all versions feature tape save and load, the disk version provides the Mini Disk Operating System common to the whole **Library**, plus disk file linking for continuous printing.

Professional features of particular note:

- Memory-Sense with **BANK SWITCHING** to fully utilize 64K, giving not just 24 or 30K, but up to 61K of workspace with the rompak version and 50K with the disk version.
- **TRUE FORMAT WINDOW** allowing you to preview the printed page ON THE SCREEN BEFORE PRINTING, showing centered lines, headers, FOOTNOTES, page breaks, page numbers, & margins in line lengths of up to 240 characters. It makes HYPHENATION a snap.
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- Automatic justification, automatic pagination, automatic centering, automatic flush right, underlining, superscripts, subscripts, pause print, single-sheet pause, and print comments.
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32K (Comes with tape & disk) \$59.95

†Sold as the Dragon Writer™ ONLY by Dragon Data Ltd. and its distributors.

VIP Speller™

NEW

A BRAND NEW SPELLING CHECKER!

By Bill Argyros

Spelling checkers are an invaluable aid to every writer. Habitual misspellings and typos can be found without the eyestrain, boredom and fatigue associated with endless proofreading. The **VIP Speller™** is a fast, machine-code proofreading program to correct any **VIP Library™** file. It automatically proofreads your documents against a 30,000 word stock dictionary, plus a dictionary you can create, and corrects typos or marks them for special attention. Unlike other spelling checkers, the new **VIP Speller** distinguishes between upper and lowercase letters, and it shows the misspelled word in context so you can be sure of your correction. Compatible with all CoCo word processors.

32K DISK ONLY \$39.95

Lowercase displays not available with this program.

VIP™

Library

VIP Calc™

(Formerly Super "Color" Calc)

TRUE VISICALC™ POWER!

By Kevin Herrboldt

- * **UP TO 5 TIMES THE SCREEN DISPLAY AREA OF OTHER SPREADSHEETS!**
- * **STATE OF THE ART LOWERCASE DISPLAYS**
- * **MEMORY SENSE WITH BANK SWITCHING FOR UP TO 40+K IN 64K!**
- * **EXCLUSIVE VIDEO DISPLAY WINDOWS — EVEN UP TO 16!**
- * **USER-DEFINABLE WORKSHEET — UP TO 512 COLUMNS BY 1024 ROWS**
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- * **LOCATE COMMAND TO FIND SPECIFIC NUMBERS, LABELS OR FORMULAS**
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VIP Calc™ is truly the finest and easily the most powerful electronic worksheet and financial modeling program available for the Color Computer. Now every Color Computer owner has access to a calculating and planning tool better than VisiCalc™, containing all its features and commands and then some, WITH USABLE DISPLAYS. Use Visicalc templates with **VIP Calc™**!

There's nothing left out of **VIP Calc™**. Every feature you've come to rely on with VisiCalc™ is there, and then some. You get up to **5 TIMES** the screen display area of other spreadsheets for the Color Computer and Memory-Sense with **BANK SWITCHING** to give not just 24, or 30, but **UP TO 61K OF WORKSPACE IN 64K!!!** This display and memory allow you the FULL SIZE, USABLE WORKSHEETS you require. You also get: User definable worksheet size, up to 512 columns by 1024 rows! * Up to **SIXTEEN VIDEO DISPLAY WINDOWS** to compare and contrast results of changes * **15 DIGIT PRECISION** * Sine, Cosine and other trigonometric functions, Averaging, Exponents, Algebraic functions, and **BASE 2, 8, 10 or 16** entry * Column and Row, Ascending and Descending **SORTS** for comparison of results * **LOCATE FORMULAS OR TITLES IN CELLS** * Easy entry, replication and block moving of frames * Global or Local column width control up to 78 characters width per cell * Create titles of up to 255 characters per cell * Limitless programmable functions * Typamatic Key Repeat * Key Beep * Typeahead * Print up to 255 column worksheet * Prints at any baud rate from 110 to 9600 * Print formats savable along with worksheet * Enter **PRINTER CONTROL CODES** for customized printing with letter quality or dot matrix printer * Combine spreadsheet tables with **VIP Writer™** documents to create ledgers, projections, statistical and financial reports and budgets.

Both versions feature Tape save and load, but the disk version also has the Mini Disk Operating System of the entire **Library**.

32K (Comes with tape & disk) \$59.95

does not allow hi-res display in 32K

NEW SALE PRICES!

Check These Library Features:

- Fully CoCo 2 Compatible
- Nine Display Formats: 32 by 16
51, 64, 85 by 21 or 24
- True Lowercase & Descenders
- Four Different Display Colors
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- Mini Disk Operating System
- Compatible With All Printers

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VIP Terminal™

(Formerly Super "Color" Terminal)

RATED BEST IN JANUARY 1984 "RAINBOW"

By Dan Nelson

From your home or office you can join the communication revolution. The **VIP Terminal™** opens the world to you. You can monitor your investments with the Dow Jones Information Service, or broaden your horizons with The Source or Compuserve, bulletin boards, other computers, even the mainframe at work.

For your important communication needs you've got to go beyond software that only lets you chat. You need a smart terminal so that you can send and receive programs, messages, even other **VIP Library** files. **VIP Terminal**, the official Dragon microcomputer terminal, does much more than any other terminal and does it reliably. None can compare in features.

FEATURES: Choice of 8 hi-res lowercase displays * Memory-Sense with BANK SWITCHING for full use of workspace * Selectively print data at baud rates from 110 to 9600 * Full 128 character ASCII keyboard * Automatic graphic mode * Word mode (word wrap) for unbroken words * Send and receive **Library** files, Machine Language & BASIC programs * Set communications baud rate from 110 to 9600, Duplex: Half/Full/Echo, Word length: 7 or 8, Parity: Odd/Even or None, Stop Bits: 1-9 * Local linefeeds to screen * Save and load ASCII files, Machine Code & BASIC programs * Lowercase masking * 10 Keystroke Multiplier (MACRO) buffers to perform repetitive pre-entry log-on tasks and send short messages * Programmable prompt or delay for send next line * Selectable character trapping * Send up to ten short messages (KSMs), each up to 255 characters long, automatically, to save money when calling long distance.

All versions allow tape load and save of files and KSMs, but the disk version also has the Mini Disk Operating System common to the **Library**.

32K (Comes with tape & disk) \$49.95

16K Rompak (While they last) \$49.95

(Tape does not allow hi-res displays in 16K)

SoftLaw

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TRS-80 is a trademark of Tandy Corp. VisiCalc is a trademark of VisiCorp.

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ARE ENCOURAGED.**

VIP Database™

(Formerly Super "Color" Database)

INCLUDES MAIL MERGE CAPABILITIES TOO!

By Tim Nelson

This high speed MACHINE LANGUAGE program fills all your information management needs, be they for your business or home. And it does so better than any other database program for the Color Computer, featuring machine code, lowercase screens and mailmerge capabilities. Inventory, accounts, mailing lists, family histories, you name it, the **VIP Database™** will keep track of all your data, and it will merge **VIP Writer™** files.

The **VIP Database™** features the **Library** Memory Sense with BANK SWITCHING and selectable lowercase displays for maximum utility. It will handle as many records as fit on your disk or disks. It is structured in a simple and easy to understand menu system with full prompting for easy operation. Your data is stored in records of your own design. All files are fully indexed for speed and efficiency. Full sort of records is provided for easy listing of names, figures, addresses, etc., in ascending or descending alphabetic or numeric order. Records can be searched for specific entries, using multiple search criteria. With database form merge you may also combine files, sort and print mailing lists, print "boiler plate" documents, address envelopes - the list is endless. The math package even performs arithmetic operations and updates other fields. Create files compatible with the **VIP Writer™** and **VIP Terminal™**. Unlimited print format and report generation with the ability to imbed control codes for use with all printers.

As with all other **Library** programs, the **Database** features the powerful Mini Disk Operating System.

32K DISK \$59.95

64K Required for math package.

VIP Disk-ZAP™

(Formerly Super "Color" Disk-ZAP)

RAVED ABOUT IN THE APRIL 1983 "RAINBOW!"

By Tim Nelson

Your database file disk, form letter disk, or BASIC program disk goes bad. An I/O error stops loading, or even backing up of the disk. Weeks, even months of work sit on the disk, irretrievable. Now catastrophic disk errors are repairable, quickly and with confidence, using the **VIP Disk-ZAP™**. It is the ultimate repair utility for simple and quick repair of all disk errors. Designed with the non-programmer in mind, the **VIP Disk-ZAP™** will let you retrieve all types of bashed files, BASIC and Machine Code programs.

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16K DISK \$39.95

Lowercase displays not available with this program.

☎ Enter 59 on TeleResponse page 159



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Space Shuttle. It takes some time to compute, but it's worth it.

I left the rotational math out of this article because there are many books and articles already describing it in detail. (See the References at the end of this article). The formulas used in this program came from *Microcomputer Graphics* by Roy E. Meyers. ■ ■ ■

♦ Programs

References

Roy E. Meyers, *Microcomputer Graphics*, Addison-Wesley Micro Books. A very good reference on all types of graphics written for the Apple but easy to convert to TRS-80C.

Franklin C. Crow, "Three Dimensional Computer Graphics," *Byte*, March 1981. Helpful background material and three-dimensional rotation.

John Ennis, "Rotational Grafx," *TRS-80 Microcomputer News*, June, 1982. 16K program somewhat like this one.

Roy Green, "Is a Rose in Color Still a Rose?," *80 Micro*, March, 1982. 16K program to rotate an object.

Line Number	From			To			Description
57	-72,	16,	-12	-70,	14,	4	Rear Engine Wall
58	-70,	14,	4	-69,	2,	16	
59	-69,	2,	16	-69,	-2,	16	
60	-69,	-2,	16	-70,	-15,	4	
61	-70,	-15,	4	-72,	-16,	-12	Left Wing Flap
62	-56,	57,	-9	-56,	16,	-13	
63	-56,	-57,	-9	-56,	-16,	-13	Right Wing Flap
64	-93,	0,	48	-87,	0,	48	Tail Flap
65	-87,	0,	48	-70,	0,	23	
66	-70,	0,	23	-80,	0,	23	
67	-69,	15,	4	-69,	18,	12	Rear Panel Of Left Engine Pod
68	-69,	18,	12	-69,	10,	20	
69	-69,	10,	20	-69,	2,	16	
70	-69,	-15,	4	-69,	-19,	12	Rear Panel Of Right Engine Pod
71	-69,	-19,	12	-69,	-11,	20	
72	-69,	-11,	20	-69,	-2,	16	
73	-69,	15,	4	-44,	13,	5	Left Engine Pod
74	-69,	2,	16	-44,	2,	14	
75	-69,	18,	12	-52,	18,	13	
76	-69,	10,	20	-52,	10,	21	
77	-52,	18,	13	-52,	10,	21	
78	-52,	18,	13	-44,	13,	5	
79	-52,	10,	21	-44,	2,	14	
80	-69,	-15,	4	-44,	-13,	5	Right Engine Pod
81	-69,	-2,	16	-44,	-2,	14	
82	-69,	-19,	12	-52,	-19,	13	
83	-69,	-11,	20	-52,	-10,	21	
84	-52,	-19,	13	-52,	-10,	21	
85	-52,	-19,	13	-44,	-13,	5	
86	-52,	-10,	21	-44,	-2,	14	
87	-80,	0,	16	-81,	3,	14	Rear Opening Of Upper Engine
88	-81,	3,	14	-82,	3,	8	
89	-82,	3,	8	-83,	0,	6	
90	-83,	0,	6	-82,	-3,	8	
91	-82,	-3,	8	-81,	-3,	14	
92	-81,	-3,	14	-80,	0,	16	
93	-80,	0,	16	-69,	0,	12	Body Of Upper Engine
94	-83,	0,	6	-70,	0,	4	
95	-82,	3,	11	-69,	2,	8	
96	-82,	-3,	11	-69,	-2,	-8	
97	-69,	0,	12	-69,	2,	8	Nozzle Of Upper Engine
98	-69,	2,	8	-70,	0,	4	
99	-70,	0,	4	-69,	-2,	8	
100	-69,	-2,	8	-69,	0,	12	

Variable List

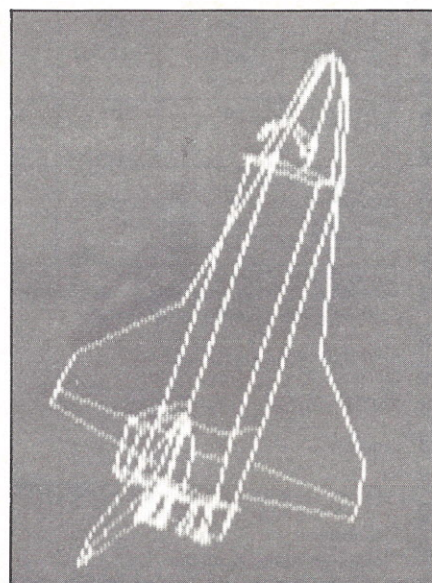
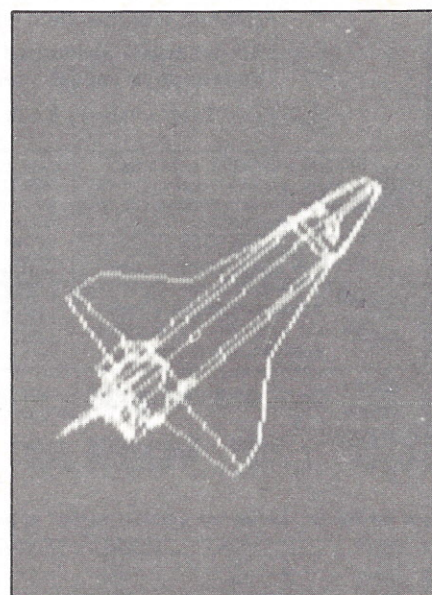
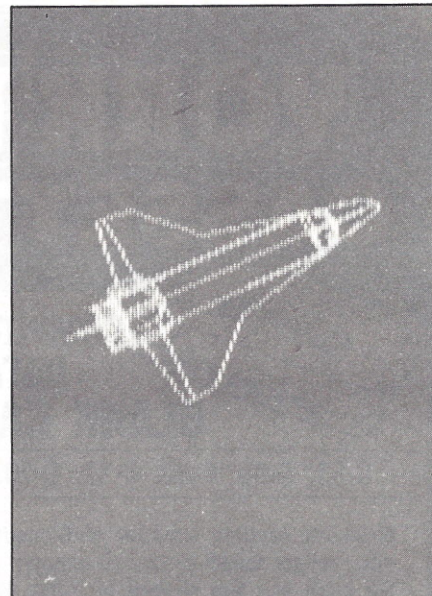
A = 1 or 0 (screen page 5 or 1)
C1 = COS (THETA)
C2 = COS (PHI)
CD = Current Data
CX = Center (X)
CY = Center (Y)
D = Distance
I = Loop Counter
L = Loop Counter
LC = Line Count (number of lines)
P1 = PHI From
P2 = PHI To
P3 = PHI Difference and Step
PF\$ = Picture File Name
PH = PHI
PI = The Value of PI
PL\$ = Notes

Q = Temporary Variable
Q\$ = Dummy Variable
R1 = RHO From
R2 = RHO To
R3 = RHO Difference and Step
RH = RHO
S1 = SIN (THETA)
S2 = SIN (PHI)
SA = Steps Allowed
SC = Scale
SP = Start of Permanent Data
ST = Number of Steps
SV = Start of Variable Data
T1 = THETA From
T2 = THETA To
T3 = THETA Difference and Step
TH = THETA

VP = Variable Poke
X1 = 3D Coordinates (From)
X2 = 3D Coordinates (To)
Y1 = 3D Coordinates (From)
Y2 = 3D Coordinates (To)
Z1 = 3D Coordinates (From)
Z2 = 3D Coordinates (To)
X3 = Calculated Coordinates
X4 = Calculated Coordinates
Y3 = Calculated Coordinates
Y4 = Calculated Coordinates
Z3 = Calculated Coordinates
Z4 = Calculated Coordinates
XA = Line From
XB = Line To
YA = Line From
YB = Line To

Line Number	From			To			Description
101	-83,	8,	2	-84,	13,	-1	Rear Opening Of Left Engine
102	-84,	13,	-1	-85,	13,	-6	
103	-85,	13,	-6	-85,	8,	-9	
104	-85,	8,	-9	-85,	3,	-6	
105	-85,	3,	-6	-84,	3,	-1	
106	-84,	3,	-1	-83,	8,	2	
107	-83,	8,	2	-72,	7,	-2	Body Of Left Engine
108	-85,	8,	-9	-73,	7,	-9	
109	-84,	13,	-3	-73,	10,	-5	
110	-84,	3,	-3	-73,	4,	-5	
111	-72,	7,	-2	-73,	10,	-5	Nozzle Of Let Engine
112	-73,	10,	-5	-73,	7,	-9	
113	-73,	7,	-9	-73,	4,	-5	
114	-73,	4,	-5	-72,	7,	-2	
115	-83,	-8,	2	-84,	-13,	-1	Rear Opening Of Right Engine
116	-84,	-13,	-1	-85,	-13,	-6	
117	-85,	-13,	-6	-85,	-8,	-9	
118	-85,	-8,	-9	-85,	-4,	-6	
119	-85,	-4,	-6	-84,	-4,	-1	
120	-84,	-4,	-1	-83,	-8,	2	
121	-83,	-8,	2	-72,	-7,	-2	Body Of Right Engine
122	-85,	-8,	-9	-73,	-7,	-9	
123	-84,	-13,	-3	-73,	-10,	-5	
124	-84,	-4,	-3	-73,	-4,	-5	
125	-72,	-7,	-2	-73,	-10,	-5	Nozzle Of Right Engine
126	-73,	-10,	-5	-73,	-7,	-9	
127	-73,	-7,	-9	-73,	-4,	-5	
128	-73,	-4,	-5	-72,	-7,	-2	
129	61,	2,	10	60,	5,	10	Window — Forward Left
130	60,	5,	10	57,	5,	13	
131	57,	5,	13	58,	3,	13	
132	58,	3,	13	61,	2,	10	
133	61,	-2,	10	60,	-5,	10	Window — Forward Right
134	60,	-5,	10	57,	-5,	13	
135	57,	-5,	13	58,	-3,	13	
136	58,	-3,	13	61,	-2,	10	
137	60,	5,	10	57,	9,	8	Window — Middle Left
138	57,	9,	8	55,	7,	12	
139	55,	7,	12	57,	5,	13	
140	60,	-5,	10	57,	-9,	8	Window — Middle Right
141	57,	-9,	8	55,	-7,	12	
142	55,	-7,	12	57,	-5,	13	
143	57,	9,	8	53,	10,	9	Window — Left
144	53,	10,	9	53,	7,	12	
145	53,	7,	12	55,	7,	12	
146	57,	-9,	8	53,	-10,	9	Window — Right
147	53,	-10,	9	53,	-7,	12	
148	53,	-7,	12	55,	-7,	12	
149	45,	13,	5	-45,	13,	4	Left Side Of Body
150	45,	-13,	5	-45,	-13,	4	Right Side Of Body
151	45,	13,	-12	48,	13,	-12	Lower Left Side Of Nose
152	48,	13,	-12	78,	6,	-9	
153	78,	6,	-9	85,	3,	-5	
154	85,	3,	-5	86,	0,	-4	
155	45,	-13,	-12	48,	-13,	-12	Lower Right Side Of Nose
156	48,	-13,	-12	78,	-7,	-9	
157	78,	-7,	-9	85,	-3,	-5	
158	85,	-3,	-5	86,	0,	-4	

For the first try, use a Distance 1 of 1200, Angle Around 1 of 0°, Elevation Angle 1 of 0°, Distance 2 of 1200, Angle Around 2 of 90°, an Elevation Angle 2 of 90°, and 3 steps.



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```

100 FOR X=1 TO 1536 STEP 6
110 PRINT"FROM X,Y,Z"
120 INPUT X1,Y1,Z1:IF X1=999 THE
N 190
130 PRINT"TO X,Y,Z"
140 INPUT X2,Y2,Z2
150 GOSUB 930:IF E=1 THEN 110
160 A(X)=X1:A(X+1)=Y1:A(X+2)=Z1:
A(X+3)=X2:A(X+4)=Y2:A(X+5)=Z2
170 PRINT
180 NEXT X
190 LC=(X-1)/6
200 GOTO 50
210 'EDIT OLD PICTURE
220 CLS:PRINT"EDIT"
230 PRINT"CHANGE (1)":PRINT"DELE
TE (2)":PRINT"ADD (3)":PRINT"LIS
T (4)":PRINT"EXIT TO MAIN MENU (
5)";
240 INPUT Q:ON Q GOTO 260,330,44
0,520,50
250 GOTO 220
260 'CHANGE
270 PRINT:INPUT"WHICH LINE NUMBE
R";LN:LN=LN*6-5
280 PRINT:PRINTA(LN);A(LN+1);A(L
N+2):PRINTA(LN+3);A(LN+4);A(LN+5
)
290 PRINT:INPUT"FROM X,Y,Z";X1,Y
1,Z1:INPUT"TO X,Y,Z";X2,Y2,Z2
300 GOSUB 930:IF E=1 THEN 290
310 A(LN)=X1:A(LN+1)=Y1:A(LN+2)=
Z1:A(LN+3)=X2:A(LN+4)=Y2:A(LN+5)
=Z2
320 GOTO 210
330 'DELETE
340 PRINT:INPUT"WHICH LINE NUMBE
R TO DELETE";LN
350 LN=LN*6-5
360 PRINT:PRINTA(LN);A(LN+1);A(L
N+2):PRINTA(LN+3);A(LN+4);A(LN+5
)
370 INPUT"DELETE (Y OR N)";QAS$
380 IF QAS$<>"Y" THEN PRINT:PRINT
"NOT DELETED":GOTO 230
390 PRINT"WORKING..."
400 FOR X=LN TO LC*6-6
410 A(X)=A(X+6)
420 NEXT X
430 LC=LC-1:GOTO 210
440 'ADD
450 LN=LC*6+1
460 PRINT"COORDINATES TO ADD":IN
PUT"FROM X,Y,Z";X1,Y1,Z1
470 INPUT"TO X,Y,Z";X2,Y2,Z2
480 GOSUB 930:IF E=1 THEN 460

```



```

490 A(LN)=X1:A(LN+1)=Y1:A(LN+2)=
Z1:A(LN+3)=X2:A(LN+4)=Y2:A(LN+5)
=Z2
500 LC=LC+1
510 GOTO 210
520 'LIST
530 CLS:A=1:B=0
540 FOR X=A TO A+4*6-1 STEP 6
550 B=B+1
560 PRINTB,A(X);A(X+1);A(X+2)
570 PRINT" ",A(X+3);A(X+4);A(X+5)

580 IF B=LC THEN 230
590 PRINT:NEXT X
600 PRINT:PRINT"HIT ENTER TO CON
TINUE"
610 IF INKEY$="" THEN 610
620 A=A+24
630 PRINT
640 GOTO 540
650 'SAVE
660 CLS:POKE65494,0
670 PRINT"WORKING...":POKE16384,
LC
680 FOR X=1 TO LC*6
690 POKE16384+X,A(X)+128
700 NEXT X
710 PRINT"DRAWING NAME (8 CHARAC
TERS OR LESS)"
720 INPUT DN$
730 PRINT"TURN RECORDER TO RECOR
D AND HIT ENTER"
740 INPUT Q$:PRINT"SAVING..."
750 CSAVEM DN$,16384,16384+LC*6+
1,350
760 PRINT"DONE-TURN RECORDER OFF
"
770 PLAY"T20CDEFG"
780 INPUT"READY";Q$
790 GOTO 50
800 'LOAD
810 CLS:POKE65494,0
820 INPUT"DRAWING NAME";DN$
830 INPUT"TURN RECORDER TO PLAY
AND HIT ENTER";Q$:PRINT"LOADIN
G..."
840 CLOADM DN$
850 PRINT"DONE-TURN RECORDER OFF
"
860 PLAY"T20CDEFG"
870 PRINT"WORKING...":LC=PEEK(16
384)
880 FOR X=1 TO LC*6
890 A(X)=PEEK(16384+X)-128
900 NEXT X
910 INPUT"READY";Q$

```

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920 GOTO 50

930 E=0:IF X1<-128 OR X1>127 OR
Y1<-128 OR Y1>127 OR Z1<-128 OR
Z1>127 OR X2<-128 OR X2>127 OR Y
2<-128 OR Y2>127 OR Z2<-128 OR Z
2>127 THEN PRINT"ERROR-MUST BE I
N THE RANGE OF -128 TO 127":E=
1

940 RETURN

■■■

Program Listing 2. Rotating Display

```
10 CLEAR10,16383:PCLEAR8 '3D ROT
ATING DISPLAY by Dale A. Keller
20 SP=16385:SV=17921:SC=1.09:PL$
="T20CDEFG"
30 '1536 BYTES FOR PERM DATA,148
47 BYTES FOR TEMP DATA
40 'LOAD
50 CLS:PRINT"LOADER":PRINT:INPUT
"PICTURE FILENAME";PF$
60 INPUT"SET RECORDER TO PLAY.
THEN HIT ENTER.";Q$:PRINT"LOADIN
G..."
70 POKE65494,0:CLOADM PF$:LC=PEE
K(SP-1)
80 PRINT"LOADED-TURN RECORDER OF
F":POKE65495,0:PLAYPL$
90 SA=INT((32768-SV)/4/LC):PRINT
:PRINT"YOU MAY HAVE UP TO"SA" ST
EPS"
100 INPUT"READY (HIT ENTER)";Q$
110 'INPUT COORDINATES
120 CLS:INPUT"DISTANCE 1, ANGLE
AROUND 1, ANGLE ELEVATION 1"
;R1,T1,P1
130 PRINT:INPUT"DISTANCE 2, ANGL
E AROUND 2, ANGLE ELEVATION
2";R2,T2,P2
140 PI=3.1416:T1=T1*PI/180:P1=P1
*PI/180:T2=T2*PI/180:P2=P2*PI/18
0
150 PRINT:INPUT"NUMBER OF STEPS"
;ST:IFST>SA THENPRINT"YOU MAY ON
LY HAVE";SA;" STEPS":GOTO150:ELS
EPRINT:PRINT"CALCULATING..."
160 'CALCULATE
170 R3=(R2-R1)/(ST-1):T3=(T2-T1)
/(ST-1):P3=(P2-P1)/(ST-1)
180 CX=128:CY=96:D=1000:RH=R1:TH
=T1:PH=P1:VP=SV
190 FOR I=1 TO ST
200 S1=SIN(TH):C1=COS(TH):S2=SIN
(PH):C2=COS(PH)
```



```

210 FORL=SP TO SP+(LC*6-1)STEP6
220 X1=PEEK(L)-128:Y1=PEEK(L+1)-
128:Z1=PEEK(L+2)-128:X2=PEEK(L+3
)-128:Y2=PEEK(L+4)-128:Z2=PEEK(L
+5)-128
230 X3=-X1*S1+Y1*C1:Y3=-X1*C1*C2
-Y1*S1*C2+Z1*S2:Z3=-X1*S2*C1-Y1*
S2*S1-Z1*C2+RH
240 X4=-X2*S1+Y2*C1:Y4=-X2*C1*C2
-Y2*S1*C2+Z2*S2:Z4=-X2*S2*C1-Y2*
S2*S1-Z2*C2+RH
250 XA=SC*(D*X3/Z3+CX):YA=CY-D*Y
3/Z3
260 XB=SC*(D*X4/Z4+CX):YB=CY-D*Y
4/Z4
270 XA=INT(XA):YA=INT(YA)
280 XB=INT(XB):YB=INT(YB)
290 POKE VP,XA:POKE VP+1,YA:POKE
VP+2,XB:POKE VP+3,YB
300 VP=VP+4:NEXT L
310 RH=RH+R3:TH=TH+T3:PH=PH+P3
320 NEXT I
330 'DRAW SCREENS
340 PLAYPL$
350 PRINT:PRINT:INPUT"HIT ENTER
TO DISPLAY";Q$
360 PMODE4,5:PCLS:PMODE4,1:PCLS:
A=0:CD=SV
370 FOR I=1 TO ST
380 FOR L=1 TO LC
390 XA=PEEK(CD):YA=PEEK(CD+1):XB
=PEEK(CD+2):YB=PEEK(CD+3)

400 LINE(XA,YA)-(XB,YB),PSET
410 CD=CD+4:NEXT L
420 SCREEN1,0
430 IF A=1 THEN A=0 ELSE A=1
440 IF A=1 THEN PMODE 4,5:PCLS:E
LSE PMODE 4,1:PCLS
450 NEXT I
460 IFINKEY$=""THEN460
470 PRINT:PRINT"SAME RUN AGAIN (
1),":INPUT"SAME OBJECT, NEW ROTA
TION (2), NEW OBJECT (3)":Q:ON
Q GOTO330,120,40

```

Program Listing 3. Scale Adjust

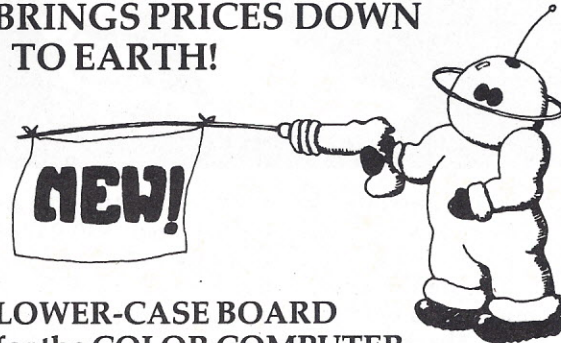
```

5 'SCALE ADJUST
10 PMODE 4,1: PCLS: SCREEN 1,1
20 LINE(50,50)-(150,150),PSET,B
30 GOTO 30

```



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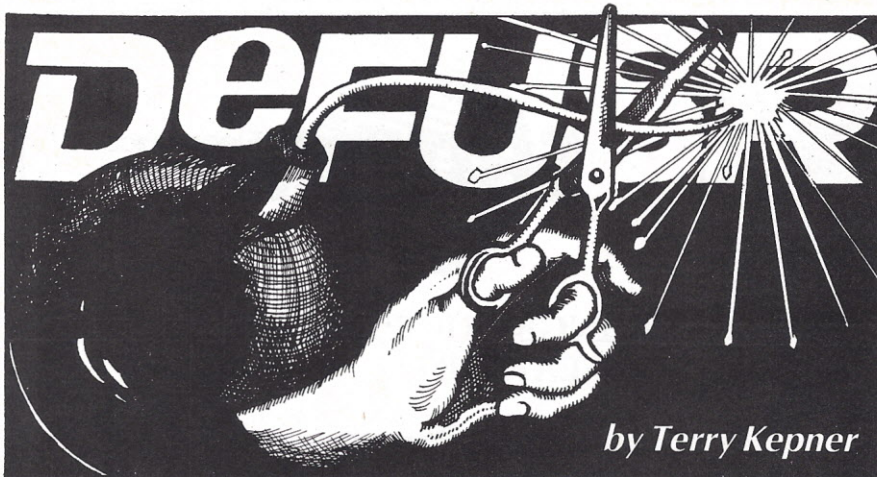
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by Terry Kepner

I have a 32K cassette-based Extended Color Basic computer. In many magazines I've seen machine language program listings, but I don't know how to type them in. Do I need Radio Shack's Editor/Assembler cartridge to do this? If not, what do I need?

— J.M., Holt Summit, MO

You need an editor/assembler, not necessarily the Radio Shack cartridge or disk. The editor/assembler combination lets you type mnemonic assembly language listings into your computer's memory, edit them to your satisfaction, then assemble the listings into machine code instructions understood by the CPU.

The mnemonics used for assembly language are two and three letter codes that are easier for an assembly language programmer to remember and use than the machine code used by the computer. For example, the machine code 00H tells the computer to do nothing, the mnemonic for that code is NOP, for No Operation. Other mnemonics are used to tell the CPU to increment the amount in the A register, or B register, or M memory location. Remembering the mnemonic INC M (increment the value in memory location M) is easier than remembering 7Cxxxx, where xxxx is the memory location. There are literally hundreds of 6809 instructions, some of which can be as long as five bytes.

You usually have editor/assembler options available that let you list the finished assembly to tape, video, printer, or (if you have it) to disk.

There are several editor/assemblers on the market including: Macro 80-C (disk, \$99.95) and SDS80C (ROMpak, \$89.95), both from The Micro Works (P.O. Box 1110, Del Mar, CA, 92014, (619)942-2400); and Co-Res9 from Cer-Comp (5566 Ricochet Ave., Las Vegas, Nevada,

89110, (702)452-0632, tape, \$29.95, disk, \$49.94). Keep an eye on ads and reviews.

Another method is to buy a machine language monitor. Most monitors will let you put machine code directly into memory. The disadvantage is that you have to work directly with the machine code, which is confusing. Mistakes can often result in the loss of the program in memory.

I have a 32K Extended Color Computer. Is there any way to interface a Radio Shack 600 baud modem with the DMP-120 printer?

— S.S., Johnstown, PA

The DMP-120 is a parallel and serial port printer, and the Radio Shack Color Computer has only an RS-232 printer port. To connect the computer to the printer, use the four-pin DIN cable sold by Radio Shack (#326-3020, \$5.95). To connect the modem to the printer, buy the Radio Shack Color Computer four-pin DIN to DB25 RS-232 cable (#26-3014, \$19.95). This cable can't be used directly, it must be modified first. The Color Computer RS-232 cable uses a different pin assignment than the Color Computer Printer cable, and you have to fix this before the cable will work.

Take apart the DB25 hood and use a pair of pliers to pull the pin from hole 3 and put it in hole 20. Remove the pin from hole 2 and put it in hole 3. This should give you a usable cable.

By the way, why do you want to connect the printer to your modem? Why not let the computer do the communicating?

I am an avid adventure game player. Where can I get material that will help me write my own games?

— J.F., Shreveport, LA

You have two choices: the first is *The Captain 80 Book of BASIC Adventure*, available from The Programmer's Guild (P.O. Box 66, Peterborough, NH, 03458, (602)924-6065, \$19.95). The book was originally written for the TRS-80 Model I, but many of the games can be converted to run on the Color Computer. This book presents several different methods and techniques in Basic program creation and execution.

The other book is *Writing BASIC Adventures for the TRS-80*, by Frank DaCosta (ISBN:0-8306-1422-2, \$9.95). Tab books publishes it. The book takes you through the theory of writing a Basic adventure and uses two adventures to demonstrate the principles. The *Reader's Guide to Microcomputer Books* gives the book a rating of 95, out of 100, based on content, quality, and relative merits (the other book is unrated).

Is it possible to connect the voice synthesizer from Spectrum Projects and a disk drive to the Color Computer?

— J.P., Mentor on the Lake, OH

You can attach them to the Color Computer simultaneously using the new Radio Shack Color Computer MultiPak Interface (#26-3024, \$179.95), the BT-2000 from Basic Technology (P.O. Box m511, Ortonville, MI, 48462, (313)627-6146, \$200), or the C-C Bus from PBJ Inc. (P.O. Box 813, N. Bergen, NJ, 07047, (201)330-1898, \$150); but, you can't simultaneously use two ROMpaks.

These units will let you switch between the ROMpaks, so you can load a program from disk, switch over to the synthesizer, then run the program. When you're finished and want to save data to the disk drive, switch from the synthesizer to the disk controller. If the synthesizer uses software built into the ROMpak, you won't be able to use it to save or load data from the disk drives, because you can only have one or the other on line at a time. The BT-2000 has slots for five cartridges, the Radio Shack unit has four and PBJ's has six.

I have an 11 month old 32K Color Computer. I use it for business applications, and it performs admirably in all respects except one — there's a lot of interference on the TV screen. While under warranty I returned it to Radio Shack for service, where it remained for four weeks. When it was returned I could detect no improve-

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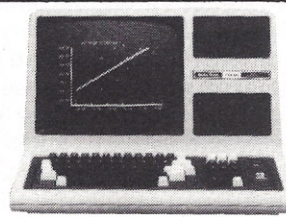
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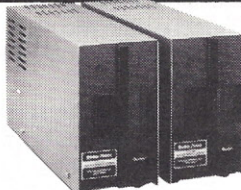
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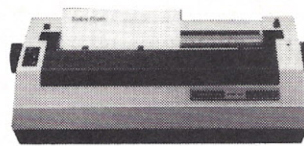
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ment. Not wanting to lose it for another four weeks, I just put up with the problem. Now I want to do something about the RFI.

The interference varies, becoming particularly bad when the disk drives are in operation. Placing my hand on top and applying pressure decreases the interference. I've tried new cables to the TV and various TV RFI filters, all to no avail. do you have any suggestions?

—H.M., Winthrop, MA

First, check the game box converter on the back of the TV for frayed connections. If the unit is loose, or has a bad connection, you can get the results you mention (mine had that problem and I had a devil of a time finding it; when I did, replacing the box cured my problem). Play with the switch box a little and see if that changes things.

Next, early production Color Computers did not have grounding clips on the cartridge port connector, which created a severe RFI problem. If this is the problem, detaching the disk drive cartridge and powering up in Extended Basic should clear up the RFI problem completely. If this does cure the problem, you

need to add the grounding clips to the port. Radio Shack should install them for a small fee, or you can buy the clips and install them yourself.

Since you say you can reduce the amount of RFI by pressing on the top of the case, I would suspect the problem might be with the RFI shield inside your computer. It might not be firmly attached, or might not be making good contact.

Open up your computer (which will void your warranty) and remove the RFI shield (the large piece of metal above the keyboard). You may have to cut a plastic tie ribbon to remove the shield. Next, solder a wire to the metal wall the RFI shield sits on and to the shield itself. This will ensure solid electrical contact. Replace the shield, reassemble the case, and test the computer. Your RF should be gone, or greatly reduced.

If you still have problems, spray the entire inside of your computer case, top and bottom, with metallic paint (after removing the computer boards, keyboard, and mounting hardware). This will form an electrical "Faraday cage" which will capture any RFI put out by the Color Computer. To complete the Faraday circuit, put a small bolt through the case

(you can't solder the wire to the case, the plastic would just melt) and ground to it. You might also want to try shielding the disk drive cables from the TV set.

Shortly after we bought our computer, we purchased and installed 64K chips. When we purchased these chips we understood Computerware to claim access to the full 64K, only to find out in the instructions that the procedure for doing that disables the ROM and Basic language.

Some advertisements we've read seem to suggest that there's a way to store data in RAM in two banks of 32K without disabling the ROM. How is it done? Will it work after the 32K upgrade which requires cutting some capacitors? Will Extended Basic be disabled?

—N.I., Athens, TX

The solution is not simple. The design of the 6809E CPU limits it to addressing a maximum of 64K of contiguous memory. In a 32K RAM the other 32K of memory is occupied by the 16K ROM and 16K cartridge ROM, for a total of 64K.

To get a 64K RAM system, you have to

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switch the 16K ROM and 16K cartridge ROM out of place and replace it with RAM. The consequences of this, of course, is that Basic is no longer available. To have both 64K RAM and the Basic ROM available would require that the CPU address 96K of contiguous RAM, which isn't possible.

The only solution is to use "bank switching" (that doesn't mean switching to First National). This is a special technique that divides the 64K RAM into two banks of 32K, and switches in the appropriate bank when needed. This lets you use (sort of) the full 64K RAM with Basic.

The "sort of" is required because you need a machine language monitor in control at all times to decide when to switch from one bank to another. This is complicated by the requirements of the Basic operating system.

When you Run a Basic program, Basic stores the variables, in the order it encounters them in your program, in memory starting at the top of the 32K RAM and growing down towards your program. When you switch memory banks, this information is "forgotten" and the new memory bank starts from scratch. Thus, updating a variable's value in one bank doesn't change it in the other.

There are several possible ways to write a supervisor routine. One way would store the program in one bank, and the variables and graphics screens in the other. The routine would transfer the Basic program line to be executed to a low memory location, select the other bank, allow Basic an open line to store data and manipulate graphics, and switch back to the other bank for the next Basic line. This limits you to a maximum program length of about 30K (no 32K because the first 2K is used by the Basic operating system).

Trying to create a larger program would require a more sophisticated bank switching routine which would automatically determine if the line number to be fetched is in bank one or bank two, and perform the appropriate fetch operation. The main difficulty with this routine would be trying to save or load the program. The ROM save and load routines wouldn't know they were supposed to switch banks, and couldn't do it anyway, so your machine language routine would have to be written to take care of this chore also.

A direct answer to your question is: Yes, you can use a full 64K RAM computer with the Basic ROM enabled, but

you need a special machine language driver routine to switch between the two 32K banks as needed. The simplest method would put the program in one bank, and the data in the other. The method used to get to 64K shouldn't matter, unless you have hardwired the SAM chip to address the memory in a specific way.

I don't know of any companies currently selling such a routine. ■ ■ ■

Update

In the October issue I accidentally gave Spectrum Projects' name as Spectrum Associates. Sorry about that, Bob.

Also, Spectrum Projects (93-15 86th Drive, Woodhaven, NY 11421, (212) 441-2807) sells an ID button that says 64K, for all you people who've upgraded and are tired of having their Color Computer labeled 4K, 16K or 32K. The button sells for \$4.99.

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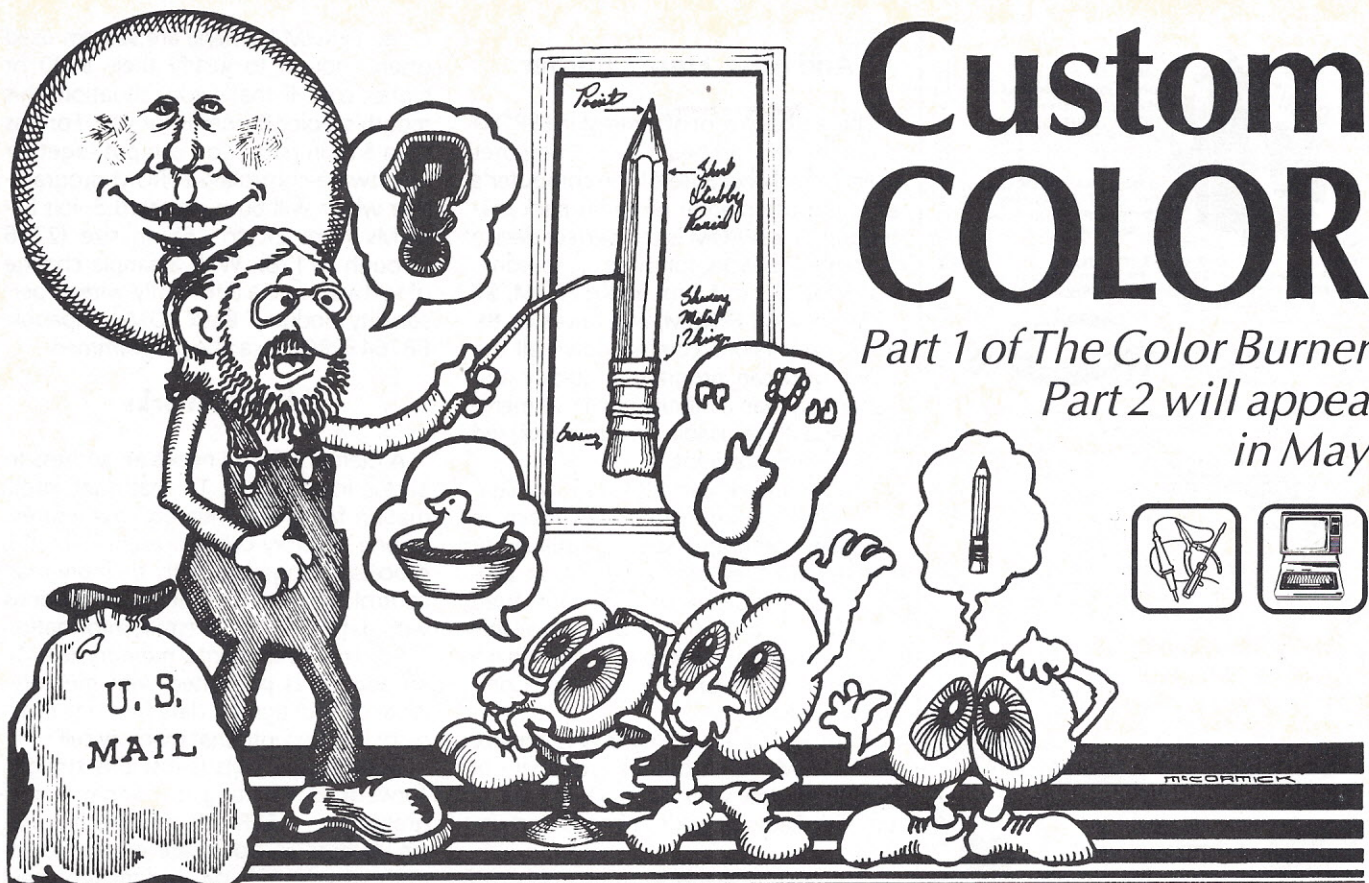
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THIS MONTH'S TOPIC is the Color burner, a project to program erasable, programmable read-only memories (EPROMs). Hear me out for the next few paragraphs, and then I'll get right to it.

Moonlight in Vermont

The moon's been full and the mail's been bad. An electrical engineer said his computer was damaged by my 64K memory upgrade article. Someone else told me I should be strung up for showing a hot cutter made with a razor blade and propane torch. Another reader thinks I should keep opinions out of my columns; only the facts, ma'am. Some say there's too much theory, others say not enough; some say too much hardware, some say not enough.

In publishing, everyone from author to printer works hard for perfection. But perfection *doesn't* often happen, because of uncaught errors in typography, spelling or grammar, or in drawings or paste-ups. To avoid potential troubles, always read an entire article; there's seldom any filler. Even what I'm saying here has a point, and the point is this: never follow instructions by themselves. Explanations, descriptions, diagrams, instructions and summaries are provided for the purpose of clarifying and cross-checking. If things look inconsistent or if you don't

by Dennis Kitz

fully understand both the theory and the directions, you have three options: figure out the correct procedure, call or write the author for help, or wait at least two months for corrections and further explanations to be printed.

Authors, editors and publishers can't be responsible for the end results of user applications and modifications. Just as each and every article can't describe how to plug in and use a soldering iron, how to open the computer, how to use the Basic language, or how to enter an assembly language listing, each and every article can't outline every precaution and safeguard to be taken. It remains your responsibility to determine whether the article suits your purpose and skills.

This isn't a defense; it's only an explanation. I apologize for the typographical errors which crept into my 64K upgrade for D-revision computers. Yes, they were my errors; I missed them in proofreading. But like those peculiar logic puzzles (Mr. Brown lives in a red house, Mr. Blue has an orange cat, Mr. Green likes purple pizza. What color car does Mr. White drive?), there was enough information in the article for a reader to be alerted that something was amiss, enough information to say, "Hey, this doesn't make

sense." If you could straighten it out, you did so; if you couldn't, you wrote or waited.

As do all **The Color Computer Magazine** authors, I take my responsibility to readers very seriously. I answer as much mail as I can, particularly if the reader has a problem understanding my explanations. I make sure my software runs in most environments and is legible and carefully commented, and that hardware has been built and tested on all Color Computer versions. Sometimes you might scratch your head because a patch in a prototype or a Poke in a program served as a temporary fix that I forgot to include by the time I wrote the article.

But we authors will come clean; we have to admit our errors because my circulation department tells me I have more than 70,000 final proofreaders out there. Once an author's proofs go back in the mail, we have to live with the article as it is; there are no second editions for us, no errata sheets to slip under the flyleaf. In fourth grade, I remember the humiliation of being made to stand up in front of the class for fifteen minutes for doing something stupid. When I do something stupid in print, I have to stand up in front of many thousands of pairs of reproachful eyes for two months. So please, read the whole article, understand it, and don't do anything you can't undo until you wait for corrections.

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And Now, Here's Burner

There's been a lot of interest in EPROM programmers among Color Computer users, mostly because of the computer's ability to use plug-in program-pack cartridges. The EPROM is the perfect device for program packs, for three big reasons: it's cheap (\$3 to \$4 for a 2K EPROM, \$7 to \$9 for a 4K EPROM, and prices on 8K and 16K versions coming down all the time); you can program it quickly and easily (less than a minute per 1K of memory); and it's re-usable after being erased under ultraviolet light.

Program-pack cartridges are convenient. They commonly contain machine language programs such as utilities or games, but they can contain Basic programs or just blocks of important, fixed data. There are 16,128 bytes available for the program-pack to use, making it a powerful extension of your Color Computer's software.

Another use for EPROMs is to replace Basic ROMs with other languages, or even to update your Basic ROMs to keep up with Radio Shack's changes and updates.

The main obstacle to using your own EPROMs is usually the fairly infrequent need to program one. Unlike software utilities, EPROM programmers (also

called EPROM burners) are seldom used often enough to justify their \$100 or higher cost. If that's your situation, this month's Color Burner is for you. For less than \$15 in parts, you can put together a software-controlled EPROM programmer which will burn standard 5-volt EPROMs from 2K to 16K in size (2716 through 27128). With a simple change of software and a differently-wired "personality module," Basic ROM compatible 68764 EPROMs can be programmed.

How It Works

A memory device needs an address to access information. To read (get information from) any memory, the address of one memory cell is presented by the processor, together with memory-read control signals. The memory responds with data. To write to (store information in) ordinary read/write memory (RAM), an address is presented with memory-write control signals; data from the processor is stored into that memory cell.

Reading EPROMs is just this straightforward. But writing to — that is, programming — EPROMs is a special case. An address and data are presented together to the EPROM, and must be held steady (stable); while address and data are being held stable, special programming voltages and control signals are

Parts List

Part:	Quantity
MC6821 peripheral interface adapter	2
7406 hex inverter, 30V open collector*	1
2N3906 small-signal PNP transistor	3
2N3904 small-signal NPN transistor	1
1N4148 diode	4
1N5251B 22-volt zener diode*	1
1N5254B 27-volt zener diode*	1
10K ohm 1/4W 5% resistor	4
4.7K ohm 1/4W 5% resistor	3
1K ohm 1/4W 5% resistor	1
100-ohm 1/4W 5% resistor	1
10 mF 35-volt electrolytic capacitor	1
47 mF 35-volt electrolytic capacitor	1
0.1 mF 50V monolithic capacitor	4
9-volt battery clips	3
16-pin integrated circuit socket	1
40-pin integrated circuit socket	2
16-pin header (for personality/modules)	1 each
28-pin zero-insertion-force socket	1

*do not substitute

Available from Green Mountain Micro, Roxbury, Vermont 05669, (802)485-6112: Color Burner assembled and tested, \$49.95, including software on cassette; complete kit of parts, \$39.95; printed circuit board, \$20 (add \$2.50 shipping and handling).

turned on for a very specific period of time. After this time, the control signals and voltages are turned off, and the next address and data are selected.

The actual programming time for most popular EPROMs is 50 milliseconds (mS), or roughly 1/20 of a second per cell, making the time per K (1,024 bytes) of memory about 51 seconds. An 8K EPROM the size of the Extended Basic, then, would take nearly seven minutes to program in its entirety. (A nice thing about EPROMs is that they can be programmed one byte at a time — program what you need, and leave the rest for expansion.)

The voltages needed for programming EPROMs are +5 volts (for power), +25 volts (for 2K and 4K EPROMs), and +21 volts (for 8K and larger EPROMs). Certain manufacturers also have self-identification information embedded into their EPROM that can be read using +11 volts, but the Color Burner does not use that feature.

The Color Burner uses three integrated circuits — two 6821 peripheral interface adapters (PIAs) to hold the address and data stable and provide control information, and one 7406 to activate the actual control voltages. Four transistors together with associated resistors and diodes are used by the 7406 to supply ground, +5, +21 or +25 volts. A plug-in wiring block called a "personality module" routes correct address and voltage information to their respective points on the EPROM. A zero-insertion-force socket holds the EPROM itself. Figure 1 is a block diagram of the activity, and Figure 2 is the complete schematic.

Look at Figure 1. There are seven miscellaneous lines running from the computer to the two PIAs. Address lines A1 and A0 select the four internal control and data registers of the PIA (refer to "Custom Color," March and April 1983, for details of the operation of the 6821 PIA). SCS* (Spare Select) decodes the

more

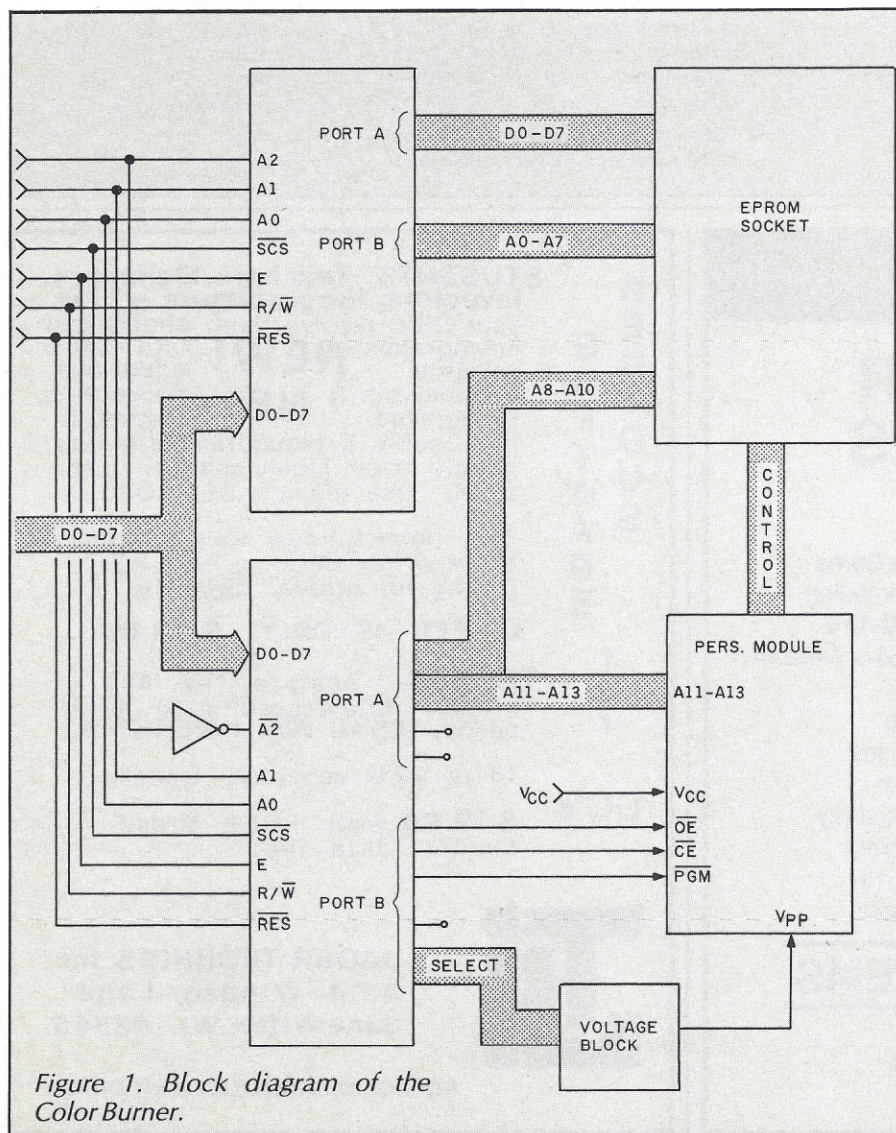


Figure 1. Block diagram of the Color Burner.



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input/output memory area of the Color Computer (addresses \$FF40 to \$FF5F), and this, together with address line A2, activates each PIA when addresses \$FF40 through \$FF43 (PIA #1) or \$FF44 through \$FF47 (PIA #2) are used.

The RES* (reset) signal synchronizes the PIA and correctly establishes all registers when the power is turned on or the Reset button is pressed; the E clock synchronizes the input/output timing with the computer's processor; and the R/W* (read/write) line identifies a read-from-peripheral or write-to-peripheral state.

The remaining eight lines represent the data to be transmitted to the EPROM socket. The data fed through the first PIA's port A become actual data read from or written to the EPROM. The data fed through port B are used to hold stable the lower eight bits of the EPROM's address (A0-A7).

Port A of the second PIA transmits the remaining six EPROM address bits; three (A8-A10) complete the group of addresses common to all EPROMs from 2K to 16K bytes. Address A11 must be added to address 4K of memory, A12 is added to address 8K, and A13 is used for 16K EPROMs. These last three addresses are fed to a personality module, which routes them correctly as needed. Two bits of port A are not used.

Table 1. PORT \$FF46

bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
0V	5V	21V	25V	—	PGM*	CE*	DE*

Programming/Reading Voltages (V_{pp}):				Control/Select Lines:			
0 = 0	0 = Z	0 = Z	0 = Z	2764	All	2716	
1 = Z	1 = 5V	1 = 21V	1 = 25V	27128		2764	
(Z = transistor turned off)						27128	

Table 2. Port Values for 2716 through 27128 EPROMs

Bits	7	6	5	4	3	2	1	0	
2716 off	0	0	0	0	(0)	(0)	1	1	= \$03
2716 read	1	1	0	0	(0)	(0)	0	0	= \$C0
2716 set prgm.	1	0	0	1	(0)	(0)	0	0	= \$90
2716 pulse	1	0	0	1	(0)	(0)	0	010	= \$90,\$91,\$90
2732 off	0	0	0	0	(0)	(0)	1	(0)	= \$02
2732 read	1	1	0	0	(0)	(0)	0	(0)	= \$C0
2732 set prgm.	1	0	0	1	(0)	(0)	0	(0)	= \$90
2732 pulse	1	0	0	101	(0)	(0)	0	(0)	= \$91,\$90,\$91
2764 off	0	0	0	0	(0)	0	1	1	= \$03
2764 read	1	1	0	0	(0)	1	0	0	= \$C4
2764 set prgm.	1	0	1	0	(0)	1	0	0	= \$A4
2764 pulse	1	0	1	0	(0)	101	0	0	= \$A4,\$A0,\$A4

(010 = level zero, pulse one, level zero)
(101 = level one, pulse zero, level one)

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The final port (PIA #2, port B) provides the necessary control signals. OE* (output enable), CE* (chip enable) and PGM* (program) are controls used in different ways by the four different EPROM sizes; not all are used by all EPROMs. Because of this, these must also be fed to the personality module for correct routing to the EPROM socket. Bit 3 of port B is not used by the Color Burner.

Bits 4 through 7 of port B select the voltage for programming or reading. For

hardware simplicity and low cost, these are software controlled functions. Look at the schematic, Figure 2. When all bits are 0, the +5, +21 and +25 volt lines are turned off, and the transistor is opened up to ground. Combined with high levels on bits 0, 1 and 2, the EPROM can be entirely deselected in software. Table 1 presents the eight bits of port \$FF46, and how they are arranged, and Table 2 shows how the bits are used to select the off, EPROM read, EPROM voltage set,

and EPROM program conditions.

Building the Color Burner

Any neat method of construction is fine for the Color Burner, including wire-wrapping, point-to-point soldering, or printed circuit board (see parts list for availability of boards and kits). Be sure to include the 0.1 mF decoupling capacitors near their respective integrated circuits to assure reliable operation. ♦ more

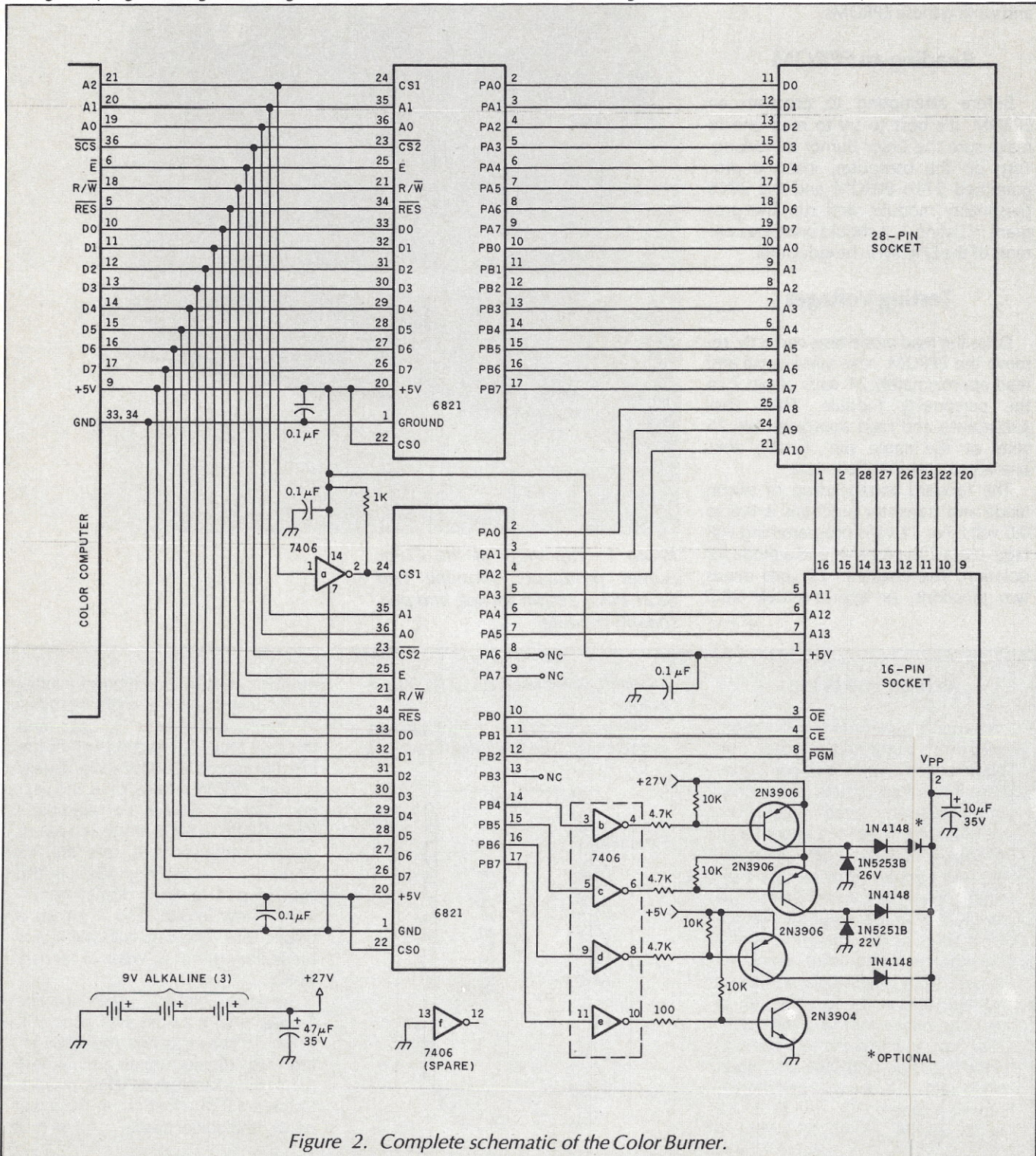


Figure 2. Complete schematic of the Color Burner.

Before using the Color Burner, be sure to test voltages, and be careful not to allow the three 9-volt batteries to touch other areas of the assembly. The results of point-to-point wiring should look something like the prototype shown in Photos 1 and 2.

Figure 3 shows personality modules for 2716 through 27128 EPROMs. Obtain 16-pin headers, and wire them as shown in the figure. Figure 4 shows the timing relationships required for reading and writing these EPROMs.

Reading an EPROM

Before attempting to program an EPROM, it's best to try to read one to make sure the Color Burner is working. Turn on the computer, insert a programmed 2716 EPROM and the 2716 personality module, and run the program in Listing 1. It should print the contents of the EPROM in hexadecimal.

Testing Voltages

Once the read mode tests correctly, remove the EPROM. POKE &HFF46,&H40 and read approximately 21 volts at pin 2 of the personality module. Then POKE &HFF46,&H90 and read approximately 25 volts at the same pin. Finally, POKE &HFF46,0 to turn all voltages off.

The forward voltage drop of silicon diode and transistor junctions is 0.6 to 0.8 volts. For 21 volts programming voltage, use a 22-volt zener and a diode for isolation. This results in 22 volts minus two junctions, or approximately 20.5

◆ more

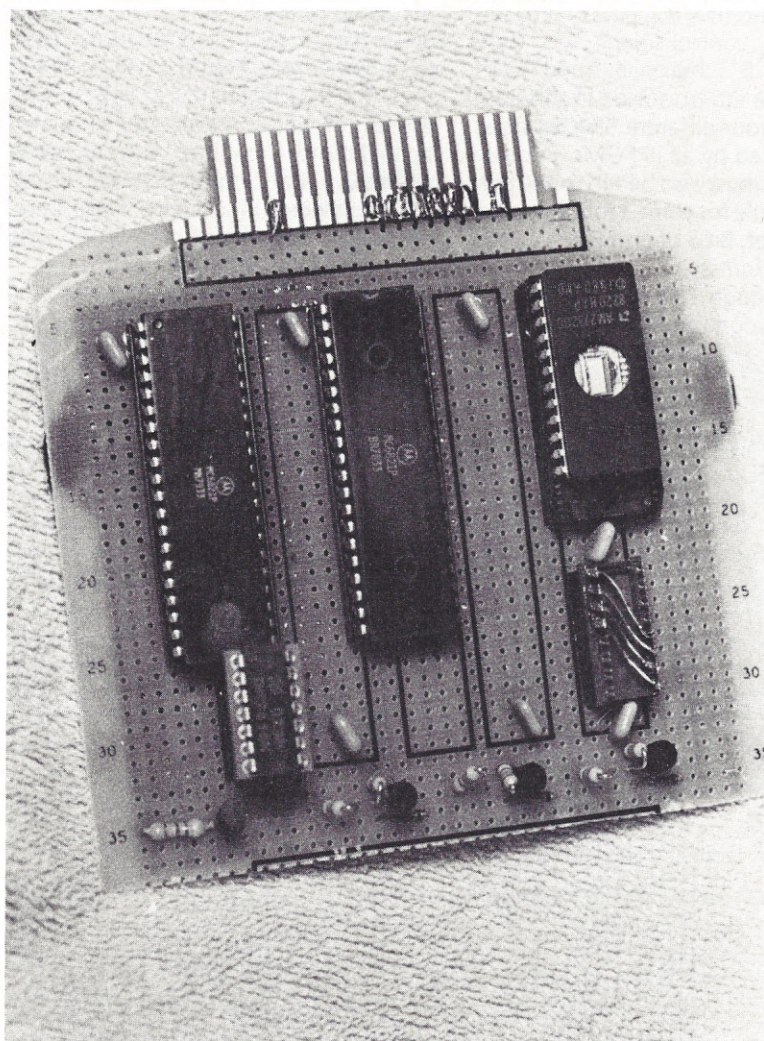


Photo 1. Top view of the Color Burner prototype, showing two 6821 PIAs, 28-pin socket, and personality module.

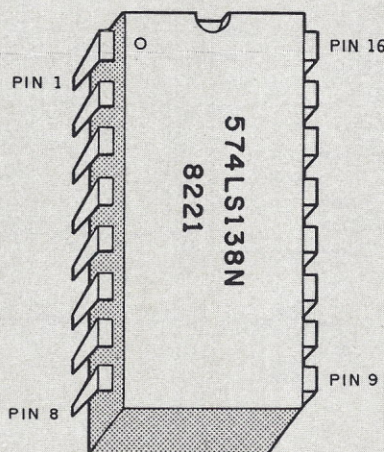
Which End Is Up?

My mail tells me it's time for a quick review of integrated circuits, the "black boxes" inside the computer. These integrated circuits (commonly, but inaccurately, called "chips") are manufactured in what's known as a DIP (dual-inline package) configuration, and contain from six to 64 external connections called "pins." To identify the numbering of the pins, locate a notch or dot (sometimes both) which clearly distinguishes one end of the part. With the pins pointed down and the notch at the top, find pin 1; it is to the immediate left of the notch.

You count *down* the left side and *up* the right side. The lowest-numbered pin (pin 1) is always opposite the highest numbered pin (pin 6, 8, 14, 16, 18, 20, 24, 28, 40, 52 or 64). A

16-pin IC (integrated circuit) is shown below.

Integrated circuits usually have two printed lines. The first identifies a part



number, usually consisting of a letter prefix or symbol to identify the manufacturer, the generic number, and the case type. The second line of the identification is the date code, usually written YYWW where YY is the year and WW is the week. For example, I find MC6847P 8004 printed on a part in my computer. MC tells me it's Motorola Corporation, 6847 is the type of part (a video display generator, I now know), and P means a plastic case. The date tells me it was made during the last week of January 1980.

So when I tell you something like "solder a wire to pin 9 of your 16K RAMs," I mean to find the 4164 integrated circuits (mine are marked MN4164P, Matsushita 4164 plastic), locate pin 9 (the first pin at the lower right), and solder there. ■ ■ ■

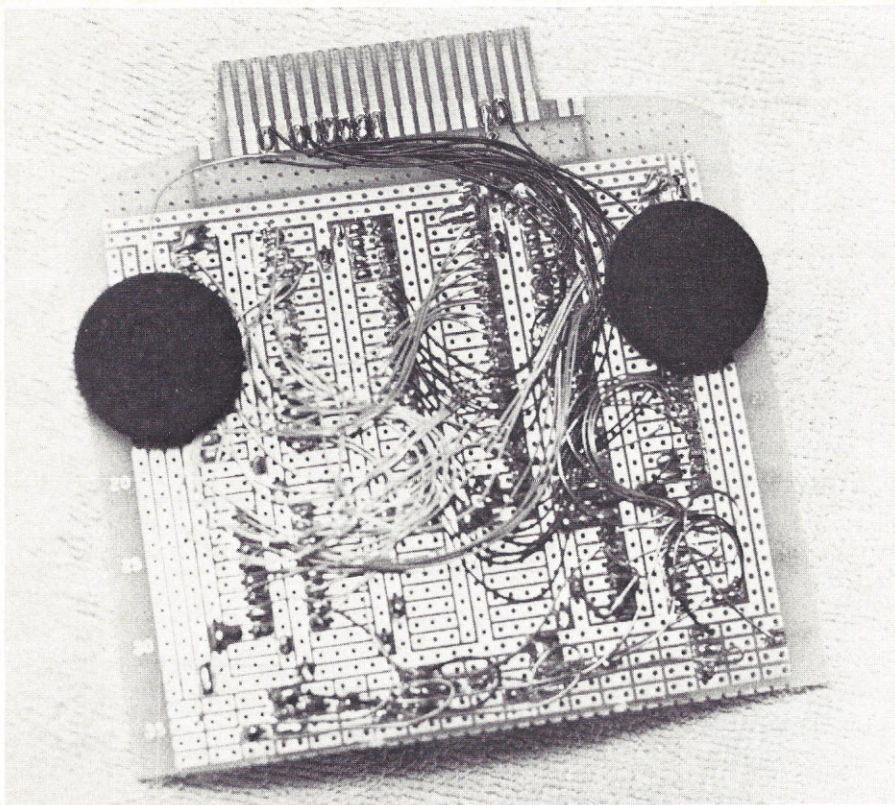


Photo 2. Underside wiring of the Color Burner prototype.

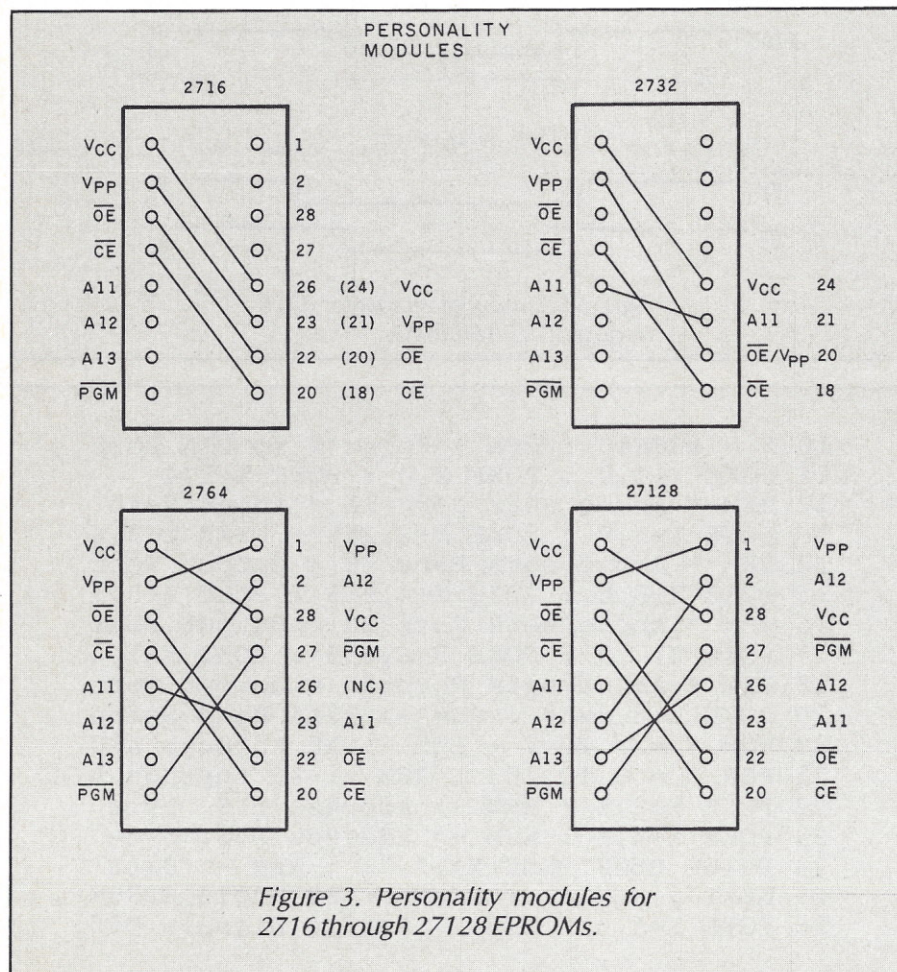


Figure 3. Personality modules for 2716 through 27128 EPROMs.

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volts. Test the voltage; if it is outside the high range of 22 volts, add a second diode. If it is outside the low range of 20 volts, obtain a zener diode of slightly higher value or tolerance, or use a germanium diode in place of the 1N4148. For 25 volts programming voltage, use a 27-volt zener plus two diodes for isolation. This results in 27 volts minus three junctions, or approximately 25.0 volts. Test voltage; if it is outside the high range of 26 volts, add a third diode; if it is outside the low range of 24 volts, remove one of the 1N4148 diodes.

Once everything works, take a break. Don't try to program anything now! Wait 'til May, when I'll present a complete software utility for the Color Burner.

Update: Access Time

Myth-dispelling time again. One of the well-guarded secrets of computer operation is what's called "access time"; when someone tells you "be sure to get 200 nS RAMs," they mean to get memories with a specified access time of 200 nanoseconds, 200 billionths of a second. And they may be wrong.

Access time is the time it takes data to be made ready for the computer's central processing unit (CPU), but that definition is deceptive. With a fistful of manufacturer data sheets, you can solve the access time mystery for yourself. I don't take much in computerdom on faith, so I decided to do a little research.

There are a lot of numbers involved. I open a Hitachi memory data book to the 64K RAMs, and turn to the HM4864 description, which runs 10 pages. It says "HM4864-3, 200 nS access time, 335 nS cycle time." Now I've got two figures. I find on the third page of the data book that access time from RAS* is specified at 200 nS, and from CAS* is 135 nS. What are RAS* and CAS*? How is this specification understood?

In dynamic memories (Color Computer RAMs are such), the address is presented in two halves — eight low address bits, and eight high address bits. RAS* and CAS* are electronic signals that define which half, and when. RAS* (row address strobe) says "here are the low address bits" and CAS* (column address strobe) says "here are the high address bits."

Nestled among the 35 memory timing specifications and 10 footnotes I find this information: "Operation with tRCD (max) limit ensures that tRAC (max) can be met, tRCD (max) is specified as a reference point only; if tRCD is greater than the specified tRCD (max) limit, then access time is controlled exclusively by

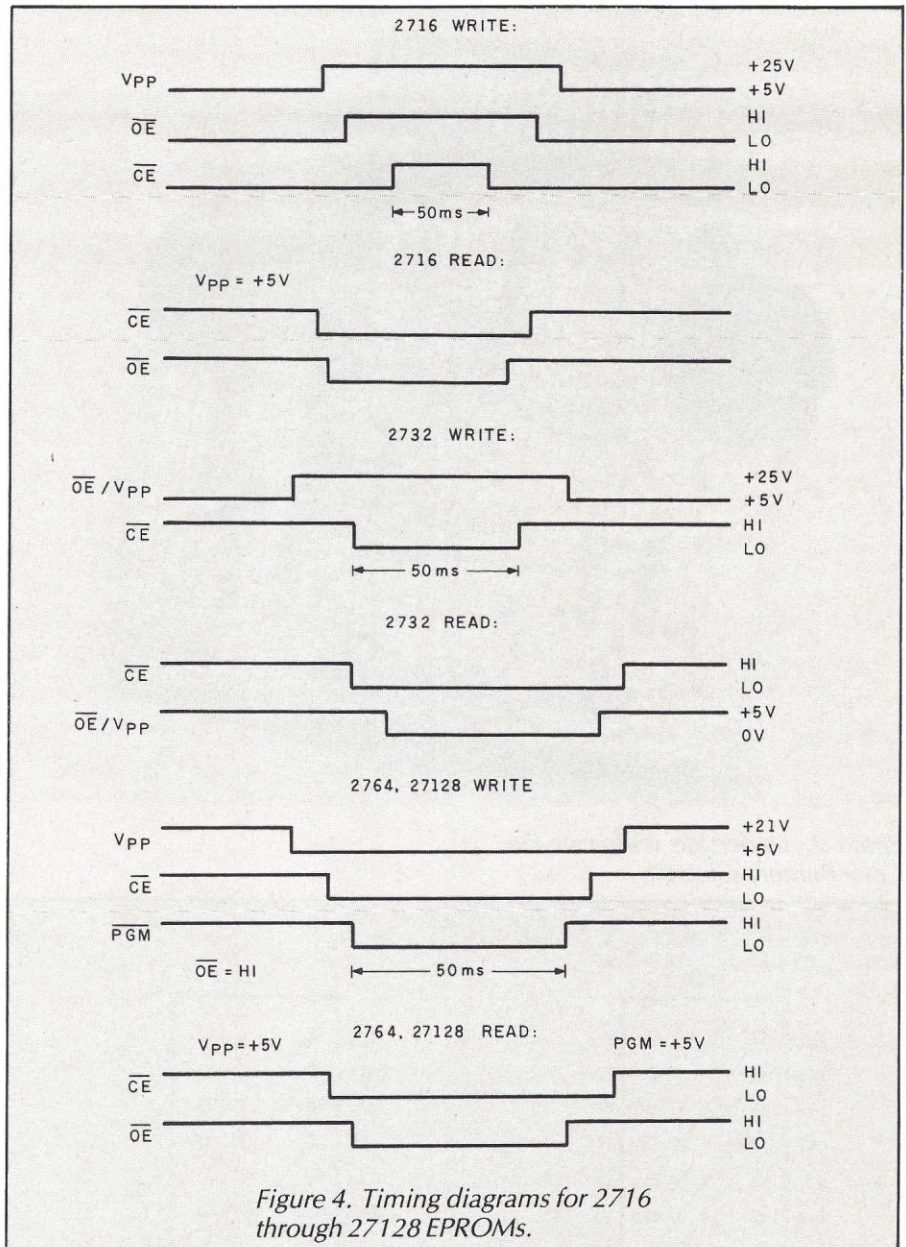


Figure 4. Timing diagrams for 2716 through 27128 EPROMs.

```

10 X = &HFF40 : REM * Point X to PIA Port
11 POKE X+1,0 : POKE X,0 : POKE X+1,4
12 REM * Above sets port 1A = Input Port
13 POKE X+3,0 : POKE X+2,255 : POKE X+3,4
14 REM * Above sets Port 1B = Output Port
15 POKE X+5,0 : POKE X+4,255 : POKE X+5,4
16 REM * Above sets Port 2A = Output Port
17 POKE X+7,0 : POKE X+6,255 : POKE X+7,4
18 REM * Above sets Port 2B = Output Port
19 POKE X+6,&HC0 : REM -> 2716 Read Setup
20 FOR Y = 0 TO 7 : REM -> A8 through A10
21 FOR Z = 0 TO 255 : REM -> A0 through A7
22 POKE X+2,Z : REM -> Address L.S. byte
23 POKE X+4,Y : REM -> Address M.S. byte
24 PRINT HEX$(PEEK(X))" "; : REM -> Data
25 NEXT : NEXT : REM -> Print Whole EPROM
26 POKE X+6,0 : REM -> Active Signals Off

```


tCAC." Uh-huh. In English, this means that there is a short space of time (in this case, 20 to 65 nS) that must be left between the RAS* row-address signal and the CAS* column-address signal. It can't be shorter than 20 nS. On the other hand, if this space is longer than 65 nS, then access time is effectively defined simply by how long the CAS* signal is held stable ... in this case, CAS* can't be shorter than 135 nS, as the specs mentioned earlier.

Now to the computer. For this, I turn to the MC6809E data sheet (that's the CPU) and the MC6883 data sheet (that's the synchronous address multiplexer, or SAM, which controls the memory access).

There are 22 timing specifications for the MC6809E, one of which is "usable access time" at 1 MHz (one million clock cycles per second). Usable access time is 695 nS (minimum). Since the Color Computer runs at .89 MHz, I can calculate that its access time would actually be slightly longer, or about 780 nS. On a straight 6809-based computer, then, memories with an access time of longer than 500 nS would be just fine.

On the Color Computer, though, this isn't the case, because the memory access is actually controlled by the

MC6883, the SAM. The timings listed for the SAM are sketchy, but one critical figure is given: timing from CAS* to RAS* is specified as 208 nS "typical." The timing from CAS* to RAS* is effectively the length of CAS*, and so it looks like 200 nS should be the access time of the memory used ... but not so fast! That answer's deceptive, too. There's still a little more work to do.

Remember what the memory data sheet said: if the time between RAS* and CAS* is greater than 65 nS, then the access time is controlled by the length of CAS*. What is the length between RAS* and CAS*? The timing specification table doesn't show it, but the timing diagrams a few pages later mention it in a footnote: it is defined as "eight cycles of Osc-Out," that is, eight cycles of the 14.31818 MHz master clock, or about 560 nS. 560 nS is definitely longer than 65 nS, so the memory access time is indeed controlled exclusively by the length of CAS*.

Two hundred nS memories need a CAS* of 135 nS or longer. It turns out that 300 nS memories have a CAS* minimum of 205 nS — almost exactly the specification of RAS* to CAS* on the SAM chip. In fact, here's a list:

Access Time	CAS* Length
150	100
200	135
250	170
300	205
350	235
400	270

Any memories with an access time of 300 nS or lower will meet the CAS* specification of the Color Computer's SAM.

Oh yes. One more thing: "cycle time." Remember it was specified as 335 nS for the 200 nS memories. Here's another list:

Access Time	Cycle Time
150	250
200	335
250	420
300	500
350	585
400	670

The cycle is the complete time from one memory use to the next memory use. On the Color Computer, the cycle time is 208 nS (CAS*) + 559 nS (RAS* to CAS*) = 767 nS. Any memory in the list meets this spec, so the controlling factor for Color Computer memories is access time. ■ ■ ■

ATTENTION, CoCo OWNERS

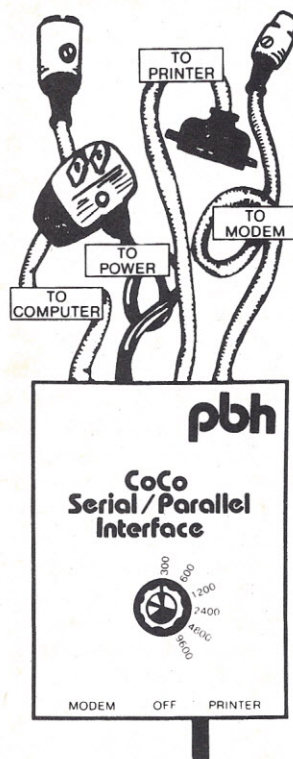
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YES, INDEED, the Color Computer is now out of the "home computer" class and into serious competition with computer systems that cost many times as much, thanks to OS/9, Radio Shack's sophisticated and powerful new operating system. OS/9 was designed with programmers in mind and has many features not usually found on microcomputer systems, but while it lets Color Computer programmers expand their horizons, it still lets them use the basic configuration that's made the Color Computer so popular all along.

Having programmed on mainframes for many years, I find the OS/9 and mainframe programming environments similar. Usually, the microcomputer does little for you. You, the user, must create everything yourself. But OS/9 takes you out of the Disk Basic environment and puts you where you can make much more efficient use of your time and effort.

The OS/9 system requires 64K of RAM. It will not run with less memory because of the system overhead required for its operation. When it's up and running, you have approximately 46K of usable memory left. OS/9 also requires at least one disk drive. It will support a printer, joysticks, RS-232C communications port, and color graphics. In other words, if you have a standard Color Computer with 64K and a disk drive, you can run OS/9.

What exactly is an operating system? An operating system is a program which manages the functions of your computer. No computer can run without one. It is the interface between you and your computer. Via your operating system, you can run your own programs, or "applications" programs. Normally, you might write an applications program in a language like Basic. Basic would then have to interface with the operating system to eventually translate Basic statements into machine language statements the computer can understand and execute. Operating systems are usually "transparent" to users, that is, they aren't really noticed once a few rules are learned. However, the power of your computer to run your programs is directly related to the power of your operating

system. The more powerful your operating system, the more your computer will do for you.

OS/9 is a powerful operating system developed by Microware for computers using the Motorola 6809 microprocessor. Radio Shack's version of OS/9 was adapted for the Color Computer last year. So, while OS/9 for the Color Computer is relatively new, OS/9 itself has been around for several years. It was patterned after an operating system for minicomputers called Unix. Unix was developed by Bell Laboratories, Inc. The Color Computer version of OS/9 has many similarities to Unix. It includes a multilevel filing system, multiuser/multitasking operations, a device-independent input and output system, and modular memory management. Let's look at each of these major features in turn.

"Multi-power"

The multilevel filing system is the heart of OS/9. It establishes a hierarchical structure of files which lets you manipulate files in a well-structured fashion. Figure 1 gives you an example of how a hierarchy of directories and files might be set up. You can set up directories and files however you wish. The "path" to any given file is given simply by describing the path to the file. For example, to delete the file called "DAILY" in the example, the following OS/9 command would be issued:

```
DEL /D0/SCHEDULE/MASTER/DAILY
```

The idea is to give the command (DEL = delete), followed by the pathlist with each station on the path separated by a slash. Organizing files like this allows for a much more structured approach to programming than XXXXXXXX.YYY file designations, with all files contained in the same directory. With OS/9, directories can be established for each function. The directories can contain all necessary programs and data files for the execution of the particular process. The ability to functionally separate directories and files is necessary when you consider the next feature of OS/9, its multiuser/multitasking ability.

"Multiuser" means more than one user can use the system at the same time. Of course, you can only have as many users as you have terminals available. Since the Color Computer only has one RS-232C port, only one terminal at a time may be connected via this port. That

means two people at the same time can use the Color Computer via OS/9.

"Multitasking" refers to the idea that the computer can be executing more than one task at a time. While these tasks are not really executed in truly simultaneous fashion, they *appear* to be taking place at the same time. OS/9 divvies up the available resources according to priorities and allows all programs to effectively share those resources. That means you can execute more than one program at once. For example, you may have one program sending output to the printer while you are editing another.

How OS/9 uses device-independent input and output is that it simply designates one device as the "standard" input device and another device as the "standard" output device. Actually, the keyboard is the default input device and the terminal screen is the default output device. If you want input to come from another source, you simply redirect the input. Output works the same way. In practice, you give an operand to a command which serves the purpose of redirecting input or output. For example, suppose I wanted to print the contents of the directory called SCHEDULE (see Figure 1) on the printer instead of the screen. I would issue the command:

```
DIR /D0/SCHEDULE >/P
```

The ">/P" indicates that output should be redirected to the printer (represented by the "/P") instead of to the normal output device. By the same token, input can come from a source other than the keyboard by using the "<" symbol, followed by the abbreviation for the appropriate device. When you get used to designating the path and the redirection of input/output, it is easy to use and very straightforward.

The advantage of this system is that programs can be developed without regard to individual input and output paths; paths can be designated when the program is run. This is similar to the way minicomputers and mainframes operate. Programs are designed to place output in designated buffers and job control language statements then direct the computer to route the contents of those particular buffers to specific output devices. Thus, to change output from screen to printer, you do not have to modify a program, you simply change the job control language. Similarly, OS/9 allows you to change the input or output path when the program is executed. For example, if WEEKLY were a program I

♦ to page 139

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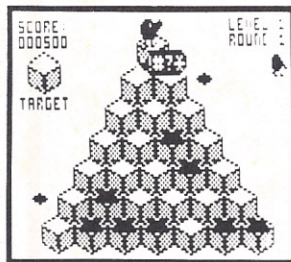
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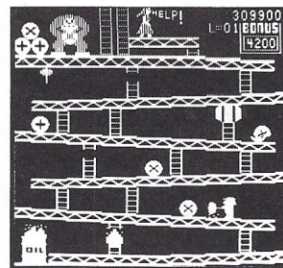
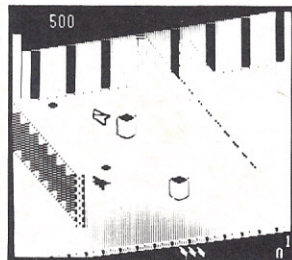


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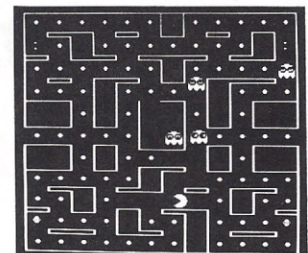


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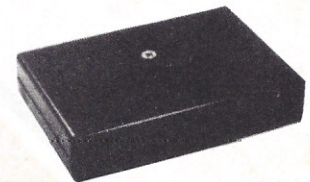
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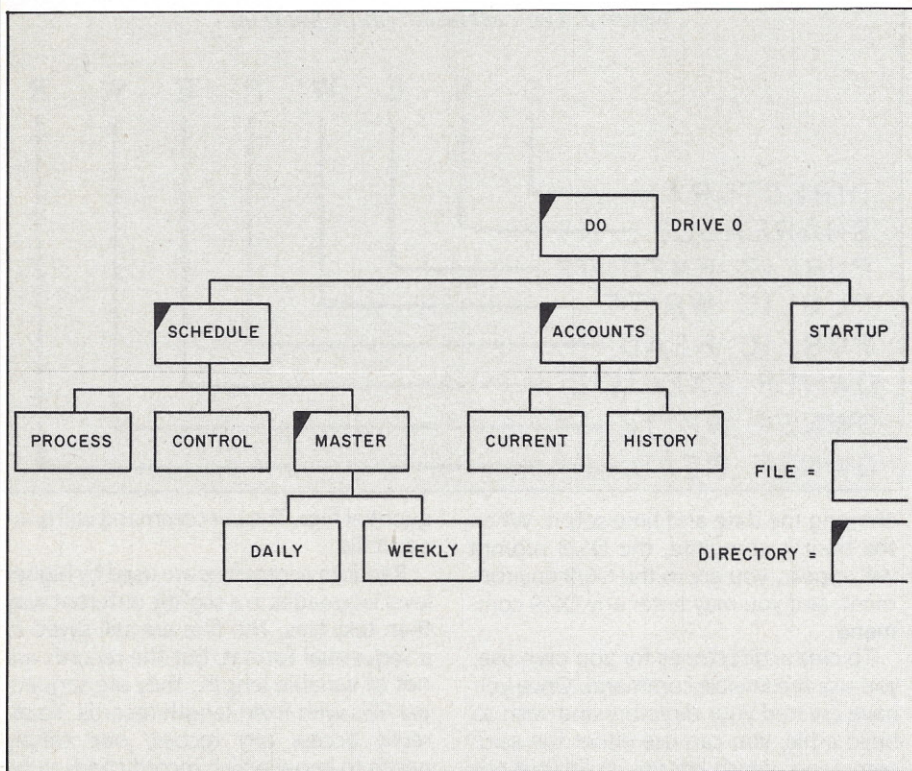


Figure 1. Sample Directory and File Configuration.

from page 134

wanted to run, I would designate the proper path and then redirect the output like this:

```
/DO/MASTER/weekly >P
```

As you can see, that's a lot easier than going into the program code itself and changing it. If you were working in Disk Basic you would have to change the appropriate PRINT statements to PRINT #— 2 statements. Then you would have to run the program with the changes. (You could get around that by having two routines in your program, one for terminal output and the other for printer output. But that increases the size of your program and it takes more memory. With OS/9, you can manipulate the input or output path at execution time.)

The fourth little treasure, modular memory management, is useful for maximizing the use of your available RAM. OS/9 allocates memory in a manner that allows the modular use of available memory. All programs that are loaded must be in memory module format. A module directory is maintained for each program. This directory contains information about the program module which includes its name, address in

memory and the number of processes using it. More than one process can use a single module. OS/9 uses a concept called the "reentrant" program that loads a program into memory and, if three different processes need the program at the same time, lets a single copy be used by all three (essentially, separate pointers are used for each process). That means that it is not necessary to load three copies into memory, one for each process. Obviously, this can save a lot of memory when using the multiprocessing feature of OS/9.

When a module is no longer needed, OS/9 deallocates the part of memory that had been assigned to that module and makes it available to another module. Other than the RAM needed by OS/9 (located at the top and bottom of free memory), all other available RAM is pooled and marked as "free memory space." Anytime OS/9 allocates or deallocates memory, it is from this pool. Using this type of management allows OS/9 to effectively supervise the logical, as well as the physical, contents of memory.

Given these four major features, what else will OS/9 do? The main advantage of a system like OS/9 over a ROM-based

system like Radio Shack Disk Basic is the fact that you can modify it. You can also create your own commands by simply writing modules to perform given functions. You can write processes of your own using existing OS/9 commands, put the commands in sequence and place them in a file. If you name the file, it will execute all the OS/9 commands contained therein. The operating system can, literally, become whatever you want to make it. There are drawbacks to the system though.

One of the drawbacks is the screen format. The standard Color Computer 32 x 16 screen is used with reverse video for lowercase. Radio Shack should have considered a high resolution screen that could be optionally switched off to conserve memory. A 51 x 24 screen format with lowercase would certainly make assembly language programming easier and would make the screen much more presentable. Lowercase is used extensively in OS/9 and after awhile it gets bothersome looking at the "checkerboard" effect caused by the reverse video form of lowercase.

The system comes complete with an editor, assembler and debugger. I found the editor to be lacking in several important areas. Other Color Computerists have gone farther and called it "gruesome." It seems that its line orientation is somewhat cumbersome to use. I would have preferred a full screen format with cursor control. The editor that is included is a very basic line oriented editor that gets the job done, but not without some initial difficulty.

The assembler and debugger, however, are easy to use and have a variety of commands that can be used to save time and effort. Generally, I had no problem learning to key in programs, assemble them and debug them using the debugger.

For those of you who do not know assembly language programming, OS/9 will support a number of higher level languages, Basic09, versions of Basic from sources other than Radio Shack, the C language, and several versions of Pascal. As the popularity of OS/9 increases, I expect to see more high level languages become available. On the applications software side, not much is available yet. Some vendors have business software available, but, generally speaking, there is little commercial software on the market yet.

Anyway, back to the positive side. One positive feature is OS/9's built-in security system. Each OS/9 file has protection codes that give you a good variety of access possibilities. Figure 2 shows a typical file attribute section of a directory entry. It shows that the sample entry is a directory, shareable, public execute, public write, public read, owner execute, owner write and owner read. If any of these values were turned off, a dash (-) would appear in the entry. For example, if the file in question were a text file instead of a directory, the first position would contain a dash. As a further example, the following entry could be a text file which is not shareable, not available for public execution, write or read, but that *is* available for owner execution, write and read. The entry would look like this:

----ewr

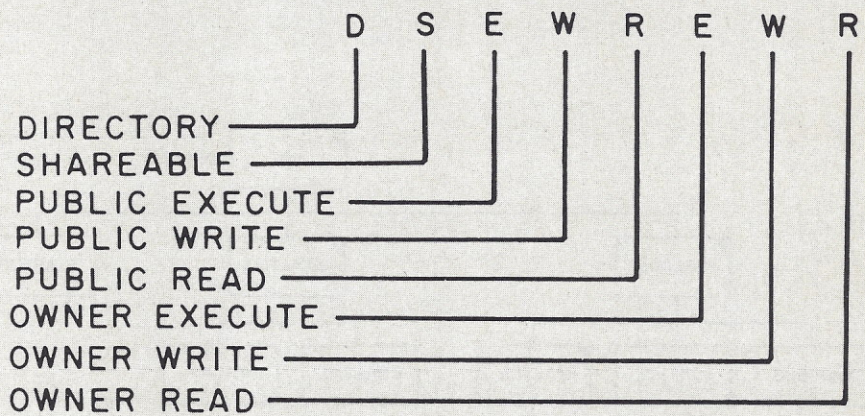
Once you memorize what each position means, you can look at the entry for any file and see what its status is. Each user can log in with a specific user ID and password, as established by the system manager (you), so everyone using the system can keep and protect their own files and not worry that others will look at them or write to them, unless you decide to make that capability available.

OS/9 fully supports the operation of the RS-232 port. It can be operated at all standard bauds from 110 to 2400. By using the XMODE command, you can examine and change settings to the port. This allows you to set up for communications or for printer output. Additionally, OS/9 will support two disk drives. Other hardware devices may be added as the need or desire arises.

Using OS/9

OS/9 comes with two disks. One is labelled "OS/9 Boot," the other is the "OS/9 System Master." To load (boot) OS/9, you insert the OS/9 Boot disk and type in one of two commands, depending on the version of Radio Shack Disk Basic that you have. If you have version 1.0, you type RUN "OS/9". If you have Disk Basic 1.1, you type only DOS and press the Enter key. A menu will appear which gives you the option of testing your drive(s) or booting OS/9. If you test a drive, its revolutions per minute will be displayed. If you choose the boot option, OS/9 will boot automatically, and you will be prompted to insert the System Master disk. Once you have inserted the System Master and pressed Enter again, you will be asked to enter the date and time. OS/9 contains a real time clock and

Figure 2. Typical File Attribute Section.



entering the date and time sets it. When the boot is complete, the OS/9 prompt will appear, you are in the OS/9 environment, and you may enter any OS/9 command.

To create directories for your own use, you use the MAKDIR command. Once you have created your directory and wish to build a file, you can use either the BUILD command, which lets you build (but not edit) a file, or you can enter text via the EDIT command, and use the editor. Either way, you can enter text and create a file. Any type of file may be created, as OS/9 does not distinguish between file types, as Disk Basic does. In general, all files are stored identically, with headers, as ASCII files. One of the first things you probably realized with Radio Shack Disk Basic was that you could not simply enter a text file as you would a Basic program. You probably had to write some kind of editor program in Basic and then run it to enter your text. The editors are already present in OS/9, so you are ready to enter text into any type of file you desire as soon as OS/9 is properly booted.

Although OS/9 does not distinguish between file types, it does distinguish between the different logical uses of files. The advantage of not distinguishing between file types is that all file handling commands may be used on all files (COPY, DEL, and so on). The logical use of any given file may vary from time to time. Logical files are categorized by the following possible uses: Text, Random Access Data, Executable Program Modules, Directories, and Miscellaneous Use.

Text files are simple ASCII files wherein each line ends with a carriage return character (hex 0D). A text file can contain program source code, data or procedure files. The text editor can be used to edit these files, as they are used as basic se-

quential files. The LIST command will print a text file.

Random access files are used by higher level languages in a slightly different way than text files. The files are still saved in a sequential format, but the records are not of variable length: they are sequential files with fixed-length records. To directly access any record, one simply needs to know which record needs to be accessed. That record can be directly accessed by multiplying the record length by the desired record number and adding the product to the beginning address of the file.

Executable program module files are object code files which can be loaded into memory and executed by the computer. Each of these files must have a header record and a cyclical redundancy checksum (CRC) value. The DUMP command is used on these to examine their contents.

Directories are organized into 32-byte records. Each record represents a directory entry and part of the record points to the actual location of the file on the disk.

Virtually any other type of file organization can be developed with OS/9, including Cobol ISAM (indexed sequential access method) files. Although Cobol is not yet available for OS/9 on the Color Computer, programmers could create any type of similar file structure for use on OS/9 disks.

When you are in the OS/9 environment, you are dealing with a "shell." The shell is that part of OS/9 that provides the interface between you and the system. When you issue a command, the system searches for a file with the same name in the following order: Memory (programs residing in memory), Execution Directory

(a directory that holds OS/9's command or user programs), and User Data Directory (a directory containing files used as "procedure" files).

If the command represents a procedure file, the file contains other OS/9 commands and the commands are executed sequentially as contained in the file, as if you had entered them, one by one, from the keyboard.

When the shell receives a command from you, it parses the command to check syntax, finds the file as explained above and executes the file as appropriate. If, for example, you gave a command such as LIST, the shell would become deactivated until LIST had completed, and then it would awaken and return an OS/9 prompt. The possibilities with shells are unlimited. You can write a program which, in effect, becomes your own user shell. Using the OS/9 shell for log-in, you could then call your own shell and spend the rest of the session with it as your shell program.

Using Assembly Language

If you want to write a program in assembly language, you could use EDIT to create the text file containing your source statements; use the assembler to assemble the source code and generate the object (machine) code file; and test the object code generated by running it, using the debugger.

If you have programmed in assembly language before, you may find OS/9 different at first. For your program to run correctly it must be position-independent, or contain no references to specific memory locations that affect the physical location of the program in memory. And all memory locations modified by the program must be addressable with relative addresses. These rules exist because chances are that your program may not reside in the same area of memory every time it's loaded. Absolute addresses are not known until the program is loaded and can vary from one load to another.

The OS/9 macro assembler contains many macros' instruction sequences that are easily accessed by an assembly language program. These macros are fully documented and are accessed with single statements. The macros are enhancements to the basic 6809 instruction set. They let programmers perform a function with a minimum of coding by calling a pre-existing block of code. The many macros available make assembly language programming in the OS/9 environment much easier than in the Disk



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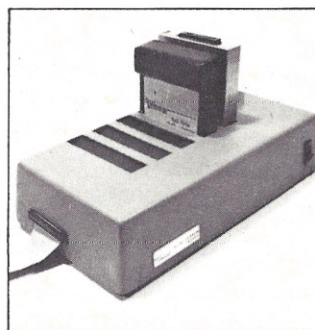
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Color Computer/141

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There are other features which will be appreciated by assembly language programmers: error handling, file handling, and including standard OS/9 definitions in your source code. There is an OS/9 file called OS9DEFS which includes 23 definitions that can be included in your source code at assembly time. Definitions include such things as OS/9 system entry vectors, process status flags and I/O error codes. By including these definitions in your source program, they can become part of your program without your having to manually include them. Additionally, OS/9 lets you save your own definitions in the OS9DEFS file for inclusion in other programs. That way, if you have routines or definitions that are frequently used in your programming, you can write them once, include them in the OS9DEFS file and never have to code them again. Just include a USE statement in your source code and the definition is automatically pulled into your code at assembly time.

Documentation

Radio Shack and Microware have done an outstanding job of documenting OS/9. Documentation consists of four manuals, each packed chock-a-block with information. In the order you should read them the manuals are: "Getting Started With OS/9," (at 34 pages); "OS/9 Commands," (at 139 pages); "OS/9 Program Development," (at 137 pages); and "OS/9 Technical Information," (at 178 pages). That's 524 pages, the best documented package Radio Shack has produced.

Information is arranged logically and large sections of reference material are arranged alphabetically. For example, in the "OS/9 Commands" manual, the first portion is designed for you to read through sequentially. It builds on previously introduced concepts to give you an increasing knowledge of the workings of OS/9. The second half contains all the OS/9 commands, listed in alphabetical order for easy reference. The manuals are nicely printed, lie flat for easy reference and are well-indexed. The technical manual contains all the information you need to interface with OS/9 when writing assembly language programs. In the limited time that I have had available to work with the OS/9 package, there has not been a question that has come up that I have not been able to answer by re-

ferring to the manuals. Updates for later releases and changes will be readily available and equally as well done, I hope.

Conclusion

OS/9 is certainly a fine operating system, but there are a few things you should remember if you're considering buying it. First of all, it's somewhat complex to learn and use. You should have some knowledge of computers beyond that required to simply run "canned" software. Part of the strength of OS/9 is its facility as a programming tool. If you are interested in programming and have a fair grasp of basic computer concepts, you could certainly use OS/9. If you do not intend to do any programming, the system might not be of much use to you. Although complex, OS/9 is straightforward, well organized and logical. While it cannot be learned completely overnight, it can be used fairly rapidly. I was programming with it after about 10 hours of familiarization.

Major OS/9 Commands

Attr	Change file attributes
Backup	Make disk back-up
Binex	Convert binary to s-record
Build	Build a text file
Chd	Change your working data directory
Chx	Change your working execution directory
Cmp	Run the file comparison utility
Cobbler	Make a bootstrap file
Copy	Copy a file
Date	Display the system date and time
Dcheck	Check the disk data file structure
Del	Delete a file
Deldir	Delete a directory and all files in the directory
Dir	Display the file names in a directory
Display	Display converted characters
Dsave	Backs-up or copies all of the files in one or more directories
Dump	Produce a formatted display of the data contents of a file
Echo	Echoes entered text to the designated output device
Format	Initializes a disk
Free	Displays the number of available 256 byte sectors on a device
Ident	Displays header information from OS/9 memory modules
Kill	Aborts a process
Link	Locks a previously loaded module into memory and ties it into others

List	Displays the contents of a text file
Load	Loads modules into memory
Login	Provides log-in security
Makdir	Creates a new directory
Mdir	Displays the present module names in memory
Merge	Merges input files to one output path
Mfree	Displays free memory in 256 byte pages
OS9Gen	Creates and links OS/9 boot file
Printerr	Prints full error messages
Procs	Displays list of current running processes
Pwd	Shows path from root directory to current data directory
Pxd	Shows path from root directory to current execution directory
Rename	Gives a file a new name
Save	Creates a new file
Settime	Sets the system date and time
Setpr	Changes CPU priority of a process
Sleep	Puts a process to sleep for a specified length of time
Tee	Copies standard input to multiple outputs
Tmode	Displays or changes the operating parameters of the user's terminal
Tsmon	Supervises idle terminals and initiates log-in procedures
Unlink	Tells OS/9 that certain memory modules are no longer needed
Verify	Checks header parity and CRC value
Xmode	Changes initialization parameters of certain devices

—by Norman Garrett

Basic Aid

Eigen Systems
P.O. Box 180006
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REVIEW\$

How about automatic line numbering? Two-key entry of common Basic words? Changing or moving segments of programs without a lot of retyping?

This review will cover two programs that offer those features and more — Basic Aid from Eigen Systems and the Platinum Worksaver from Platinum Software. For this review, I used the Basic Aid ROMpak Version 1.2, and Version A-4 of the Worksaver.

I call this type of program a programmer's utility. I don't want to imply that you have to be an expert to use them, because either program can help you as soon as you see the first OK prompt.

The major feature of a programmer's utility is that it allows two-key entry of many Basic commands and functions. This is accomplished through a seldom used key (like the down arrow key), made to function as a control key. Since these programs use different keys for the control key, CTL will indicate the control key. So, when you see the sentence, "Type CTLH," it means to press the control key (down arrow for Basic Aid, Clear or Break for Worksaver) and then type H.

Documentation

The Worksaver documentation consists of a 28-page manual with a four-page addendum containing corrections and additions for Version 4. Basic Aid's documentation is seven stapled pages. The instructions for both programs were adequate. Worksaver is a more complex program, so some of the instructions are difficult to understand until you have worked with the program awhile.

Features

Table 1 is a list of the major features of a programmer's utility. Rather than review each product separately, I will go down the list and cover each product's strengths and weaknesses.

- Easy entry of keywords: Both programs come with a keyboard overlay and allow two-key entry of a number of Basic commands and functions.

Basic Aid uses the up arrow key as the control, so if you press the up arrow while pressing Y, the GOSUB command will be written on the screen.

Worksaver covers more commands by using two control keys — the Clear key and the Break key. If you type Clear G you will get GOSUB, while if you type Break G you will get GOTO. In this way, Worksaver covers 80 Basic keywords, while Basic Aid only covers 43.

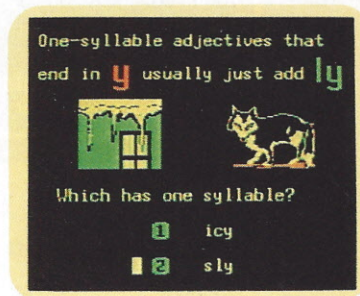
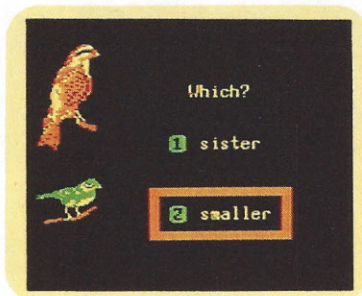
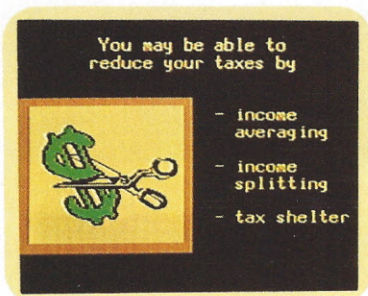
With the keyboard overlays to show each key's function, the purchase of a programmer's utility is feasible even for the complete novice. Even if you're typing in programs from **The Color Computer Magazine**, these programs will be a great help.

- Both programs allow simple redefinition of most of the keys. For example, since I don't use trigonometry functions much, I redefined my comma key so that FIELD is printed whenever I type CTL,.

Worksaver also offers automatic execution of redefined commands. Instead of printing the command on the screen, you can execute it without pressing Enter. I put this to good use by defining the N key as DIR: ? FREE(0). In this way, all I have to do is type CTLN and I get the directory listing and the number of free granules.

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Once the keys are defined to your satisfaction, you can save your changes to tape (or disk with the Worksaver). The Worksaver also saves the key definition table whenever you Save (or CSAVE) a Basic program. For example, you could write an adventure game, redefine some of the keys as "Go North," "Drink," and have two-key entry of these phrases whenever you load the game with the Worksaver. (If I had two-key entry of "Bash Troll" for "Keys Of The Wizard" I'd still be alive today.)

- Both programs allow automatic line numbering (ALN), with user-definable starting points and increments. Basic Aid is easier to use this way. All you do is type CTL 6 to toggle ALN on and off. With Worksaver you have to reset the increment to 0 (zero) to disable ALN.
- Both programs let you merge programs on cassette. The programs must be saved in ASCII (CSAVE "PROGRAM",A) format.
- Worksaver's full screen editing function lets you move the cursor anywhere on the screen for text entry. This makes

Extended Basic's edit command obsolete and is a dream come true for anyone who has tried to edit a line like this:

```
500 PLAY"T302L4DDAAGFED-CDEFL2.AL4DDA
AGFED0 1 CDEFL2. AL4ABAB-GAB-O3 C"
```

The syntax error hints that one of your O's is a zero! How can you fix it? With Color Basic you must retype the entire line. With Extended Basic's Edit command you have to count the spaces to move over before you make the change. With Worksaver's full-screen editor, just List the line, move the cursor with the arrow keys over the offending zero, type the letter O, then press Enter; it's as simple as that.

- Worksaver is fully disk compatible, with easy to understand instructions for saving to disk. Being a ROMpak by trade, the Basic Aid that I used cannot be used with disk. Eigen Systems does sell a disk version of Basic Aid.
- Memory used: The Worksaver uses over 2K of memory (2137 bytes to be exact), while Basic Aid uses a scant 227 bytes.

• Moving Program Segments: Anyone who's done much programming has run into the problem of moving blocks of code. After typing 70 lines of code you realize that some early routine should have been at the end of the program. Basic Aid and Worksaver both have features for manipulating blocks of program lines. Each is quite different from the other and both are very powerful for specific tasks.

Basic Aid lets you define a block of code (for example, Lines 10 to 100) and move it to a new location with new increments (perhaps to Line 1000 with an increment of 10). It automatically takes care of any GOTOs and GOSUBs inside and outside the block being moved. This is a Move function, not a copy — once you have made the move, Lines 10 to 100 are gone.

Worksaver does not have a specific Move/Copy function, but lines can be manipulated by means of the full screen editor and auto-line numbering features. In order to move Lines 10 — 100 to Line 1000, you would first set the auto-line number to an increment of 10. List Lines 10 — 100, move the cursor over the number 1 in 10 and type 1000. After hitting

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TRS-80 Color Computer Program Writing Workbook, by Ron Clark, 96 pages, 8 1/2x11, ISBN 0-86668-816-1. **\$4.95**

REVIEW\$

Enter the cursor moves to the next line, automatically making it 1010. This continues until all the lines are moved.

As I said, both features are powerful, but do have some drawbacks. Basic Aid is fine if you want a segment moved and not copied. It's very convenient not to have to worry about GOSUBs and GOTOs. It's a very clean move.

Work saver requires more care, but offers more versatility. Since the program doesn't eliminate the original line, and since the full-screen editor can be used to change more than just the line number,

complex coding can be done in a short time. Take the following example:

```
10 IF X<1 AND Y>5 THEN Z$=CHR$(128):GOTO 500
20 IF X>1 AND Y<5 THEN Z$=CHR$(129):GOTO 500
30 IF X=1 AND Y=5 THEN Z$=CHR$(130):GOTO 500
```

After typing Line 10, Lines 20 and 30 can be typed with only four keystrokes each. Move the cursor over the 1 in Line

10 and type 2. Move the cursor to the < and type >. Move to the > and type <. Move to the 8 in 128 and type 9. Finally, push Enter and Line 20 is complete. Line 30 can be similarly entered.

• Both programs can be turned off and back on again as the occasion requires.

Other Features

Work saver has one major feature I haven't seen in any program of this type. They call it dynamic editing, and it involves changing a Basic program without losing data. For example, enter the following program (exactly, including the error):

```
10 FOR X=1 TO 5
20 INPUT A$(X):NEXT X
30 FOR X=1 TO 5
40 PRINT A$(X):NEXT X
```

Run the program (type anything to answer the input prompts); then edit Line 40 and correct the error. Now, from the command mode, type PRINT A\$(2); naturally, the data is gone. Not so with Work-saver's dynamic editing. Even after editing Line 40, your data still exists. Just type

Feature	Basic Aid	Work saver
Easy Keyword Entry	Y	Y
Redefine Keys	Y	Y
Save Redefined Keys	Y	Y
# of Basic Words Defined	43	80
Automatic Line Numbering	Y	Y
Cassette Merge	Y	Y
Full Screen Editing	N	Y
Dynamic Editing	N	Y
Disk Compatible	N	Y
Move Program Segments	Y	Y
On/Off Switch	Y	Y
Memory Used	227 bytes	2137 bytes
Cost	\$34.95	\$35.00

Table 1. Comparison Chart

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GOTO 30 and the program will continue with your data intact.

This function has its limitations, though. If the error occurs in a subroutine, you may have a tough time figuring where to re-enter the program without getting an RG error. If you're careful, this feature can be worth the price of the program.

Conclusions

Work saver offers some unique features that are hard to pass up. It is a complex program, however, and tough to learn. If you press the wrong keys, you may spend quite a while looking through the manual trying to get out of the mode you're in. Save your programs frequently while using the Work saver (this should be done anyway).

All in all, I found the Work saver to be a true work saver, and use it whenever I have more than just a few lines of code to enter.

Basic Aid, on the other hand, is easier to use than the Work saver. Its limited memory use makes it an excellent choice for a 16K cassette user.

No matter which you choose, your fingers will thank you. — by John Boals

RS-232 Three-Way Switcher

DSL Computer Products
13726 W. Warren
Dearborn, MI 48126
(313)582-8930

\$39.95 (three-way), \$29.95 (two-way)

HAVE YOU HAD IT with having to unplug the darn printer every time you want to use your modem? I decided to do something about it one day when I broke one of the jacks on my cable. My search for a better way led to the RS-232 Switcher.

The Switcher comes in three models, one with a pair of RS-232 positions, one with a pair of RS-232 positions and an "off" position, and another with three RS-232 positions. I tried the three position switch, as I had three potential uses for the RS-232 port.

Physically, the Switcher is nothing more than a box with three four-pin female connectors on the back, a short cable with a four-pin male connector, and a three-position switch on the front, marked simply "1, 2, and 3." The idea is

to plug the Switcher into your RS-232 port, then plug your accessories into the Switcher as if it were the back of your Color Computer. Then the RS-232 output/input of your Color Computer is routed to whichever of the three Switcher lines is set.

In my case, I connected the three ports of the switcher as follows: the standard serial interface to my DMP-120 printer, another standard serial interface to my Radio Shack Modem I, and a parallel interface to my DMP-120 printer using a Botek Instruments CCP-1 Serial to Parallel Converter.

I use the standard serial interface to print graphics on my printer (besides switching the Switcher to the proper selection, I also have to set a DIP switch on the printer to set it to serial mode). When printing text of any kind, I route the output through the parallel converter. That cuts my throughput time by 50-65 percent over standard serial printing. When using my modem, I simply switch to the modem setting and I'm in business.

The Switcher is easy to set up and use. All you really need to do is keep track of the switch positions you have set up. To do that, I used an embosser (labelmaker)

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and slapped the settings to the side of the switcher.

The Switcher is made of heavy-duty plastic and has a large switch selector. Its dimensions are roughly 3-by-5-by-1½ inches, so it's easy to tuck out of the way yet still have handy.

Of all the hardware accessories I have, the Switcher has saved me the most time and effort. For the price, it's well worth the money, not to mention the wear and tear on your jacks and cables caused by constant plugging and unplugging. Give yourself, and your system, a break, and give the Switcher a try.

—by Norman Garrett

Pro Color File Enhanced

Derringer Software
Box 5300
Florence, SC 29502
(803)665-5676
\$79.95 disk, 32K

PRO COLOR FILE Enhanced performs not only as a database but as a calculator, sort of a modified spreadsheet program. Despite its documentation problems, it's a nice tool for detailed billing, inventories and general accounting.

The major difference between Pro Color File Enhanced (PCFE) and the old Pro Color File is that PCFE has eight report formats instead of five, a new summary feature for reports, a new posting routine, and a much improved labelling routine.

I used PCFE for my commercial photography billing. The set-up required 40 fields (I could have used all 60 available to me) within three segments. PCFE provides four segments, each containing 15 fields. I set some of the fields to standard items such as name, address, date and phone. However, the rest of my required categories were film, processing, Polaroid, mileage, shot description, processing, modeling fees, and so on. Many fields were duplicated, since I have to itemize types of film, Polaroid, and processing. Looking at my set-up, it seems repetitive in places, but every field is painfully necessary.

After you format fields and set up the data screen you can set equations into

your formats. I set them up to figure my costs for film, traveling, and processing. The big equations figured out the total shooting bill. Setting the equations was the easiest section to do.

Some of PCFE's features include the ability to copy the program, 1020 bytes available for record data, easy editing, colors for making data entry simple and obvious, eight report formats, label printing, various indexing and sorting functions (including the ability to sort on three fields), summary reporting and printing, account posting, and the use of a limited menu to save time when selecting different functions of the program. Other features include subtle refinements of the capabilities mentioned above.

Putting some initial problems aside for the moment, I found this program easy to work with, especially when entering data and getting print-outs. Some functions that exist but I haven't yet tried out include searching for fields based on numeric values, and/or selection options, and killing an entire format. My needs aren't nearly this great — yet.

The program is great, once it's up and running. The manual is not very helpful, especially when you're trying to set up data segments and data screens. The manual is not written in a truly step-by-step fashion nor does it offer pictures of actual screen displays. Granted, that would require more work on the manufacturers part, but I feel it would be crucial for beginners.

A detailed step-by-step sample program, showing actual keystrokes and results would have saved all kinds of time. The beginning of the manual tells you to make a backup of the program disk. One problem: it doesn't tell you how. To add ten lines of explanation would save beginners the trouble of searching their Radio Shack manuals for the procedure. There are numerous typos, some grammatical errors, and even a page missing. And curiously, some sections are more detailed than others. For instance, section D 5.3, "Moving The Display Window," explains how to move the cursor while editing report formats. Unfortunately, it doesn't tell you that the cursor disappears; it does tell you to type "R" to resume editing. So you lose the cursor and, momentarily, panic. Hit "R" and there it is again, but the manual doesn't tell you what is going to happen or even why. Granted, this is a small point but the manual is full of similar glitches.

Fortunately, when I had troubles, I called author Dennis Derringer, who was helpful and polite. If you start getting frustrated, don't quit, call Dennis.

My real beef concerns report formatting. My billing set-up requires 40 fields, and most are quite different in structure and length. PCFE does not seem to allow a report format for the printer or screen to be arranged to accommodate even half of the required 40 fields. I got around this by printing the bill while in the data entry mode. The program allows only two lines to set up report formats, which just isn't enough if you have a lot of fields that all have to be printed in an unusual manner.

The drawbacks are not nearly enough to keep me from highly recommending PCFE, though. It's full of functions a small to medium-sized business can use. Those businesses may have no trouble with report formatting and printing. If they do they ought to persevere — the program is worth it.

—by Charley Freiberg

Spell-Rite

Eigen Systems
Box 180006
Austin, TX 78718
\$59.95

CONSIDERING the fact that spelling checkers are usually notoriously slow, and that cassette searches are even slower, I was curious why anyone would develop a program like Spell-Rite.

Spell-Rite and its 19-page manual is on a "protected" tape, so you cannot simply CLOADM it and save it back. Eigen Systems gives you two tapes with a copy of the program on each, but a program like this should not be protected as it is because of the large amount of use that could be expected from it. There is a bonus program on the back side of the tape: an indexing program that allows you to generate index files for your documents.

To use Spell-Rite, type CLOADM, and watch it auto-load. After a minute you will see the main menu, and then you may load a dictionary. Spell-Rite comes with a 10,000-word dictionary; you can create your own dictionary and add words to any existing dictionary, too. The 10,000-word list only took about two

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minutes to load because Eigen Systems uses a compression algorithm to pack a lot of words into a small space in memory.

After the list is loaded, you tell Spell-Rite to verify your document. Spell-Rite reads ASCII text files directly from tape. This means it will work with any word processor that produces an ASCII output file, such as Telewriter and Super Color Writer II. Because Spell-Rite reads one line at a time from the tape, there is no limit to the size of the text file that you may proofread.

There are two verify modes, manual and automatic. The manual mode stops the search every time a suspect word is found, and asks you whether you wish to add that word to the dictionary. The automatic mode adds all suspect words to the dictionary without prompting you. Spell-Rite will allow you to get a printed list of the "bad" words if you have a printer, too.

You can create lists three ways. You can type words into the program (slow). You can also read a file from a tape (but have to put words *there* first). The best and fastest way to create a dictionary seems to be to make a fake document containing only the words you want to add, and use the auto-verify mode to add them to the dictionary. But unfortunately, Spell-Rite is lacking in the performance department.

Spell-Rite's biggest handicap is its small dictionary. Ten thousand words sounds like a lot, but it's only about five percent of the words in the English language. Because of its small size, Spell-Rite's dictionary flags such common words as "done" and "between" as being questionable. There's room for 400 extra words in the standard Spell-Rite dictionary, so you won't be able to add enough extra words to make up much of the deficit, unless you're already an exceptional speller.

Spell-Rite is also rather slow. It takes about four minutes to verify a 300 word document, not really much faster than manual checking. Spell-Rite also has no provision for correcting documents.

A bug that may limit its usefulness is Spell-Rite's habit of crashing when it sees a "word" with no alphabetic characters, for example a dash. Because of this, you cannot use the "-" or "=" symbols to underline headings. That's okay if you have a smart printer with underlining;

unfortunately, not all of us are so well-endowed.

Eigen Systems is to be commended for a game attempt at helping beleaguered cassette users, but \$59.95 will buy one heck of a good dictionary.

—by Chris Erving

(Eigen now says the problem of Spell-Rite crashing when a "word" without alphabetic characters is entered has been fixed in those versions of the program currently available. —Ed.)

VIP Terminal

Softlaw

9072 Lyndale Avenue South
Minneapolis, Minnesota 55420
(612)881-2777

**ROMpak and cassette, 16K
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THE COMMUNICATIONS capabilities of VIP Terminal, formerly Super Color Terminal 3.0, allow you to set up a communications link to practically any computer. With a minimum of effort, I have done file uploading and downloading via links to a PDP 11/70, an IBM 3081, an IBM 4341, an IBM PC, a TRS-80 Model III, an Apple IIe, and CompuServe. As long as you research how to set it up, practically any configuration is possible when communicating with another computer using VIP Terminal.

VIP Terminal has a feature called "memory sense." Upon loading the program (I have the disk version), memory sense dynamically determines the amount of memory available and sets itself up accordingly, with the largest buffer size possible. When it is ready, pressing any key will display the menu, which gives you the following options: *communications, changing communications parameters, clear buffer, load a tape, create a tape, display a buffer, print buffer contents, maintain KSMs (keystroke multipliers), disk commands, and exit to Basic*. Remember to determine the settings you need before you run the program, and to have your modem properly connected via the RS-232C port. There is no online help available, so be thoroughly familiar with the documentation in order to be able to make full use of all of the VIP features.

In general, the menu order is not the order in which you should conduct your communications. Let's go through a sample communications session and discover the numerous features as we go.

After the memory sense automatically sets the maximum buffer possible for your computer the main menu appears. The buffer that has been set up may be used to save part or all of your terminal session and can later be copied to disk or tape. By the same token, the buffer can be loaded from disk or tape before setting up communications.

For this sample session, let's communicate with CompuServe, upload a file, clear the buffer and download a message from E-Mail. First, we want to make sure we are completely set up, so as not to waste valuable on-line connect time. First, we will select from the menu option eight "maintain KSMs," or "keystroke multipliers." These handy devices allow you to program key(s) so an entire line of characters can be transmitted with one tap of the finger.

Up to 10 KSMs may be created and each may consist of up to 250 characters. KSMs are used when in communication mode by pressing the Clear key and any number key (0-9). To create new KSMs, option eight, "maintain KSMs," is used. First, we enter "E" (for edit) to create a new KSM. We are given the option of whether or not to include a carriage return at the end of our KSM. While in this mode, we may want one KSM to log on, a second to give our password, and others containing various CompuServe commands. When we have finished creating our KSMs, we can save them to tape using an "S" command. If we have previously saved KSMs on tape, we can load them using the "L" command. To save KSMs to disk or load them from disk, we must exit the KSM option (using the Break key) and return to the main menu.

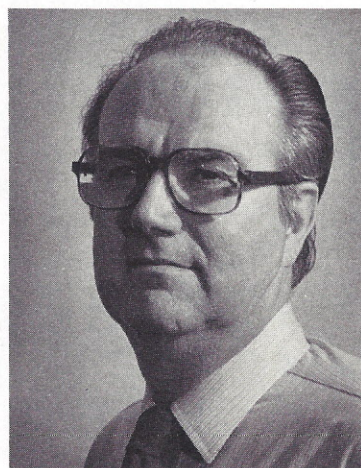
To save our KSMs to disk and load the file we want to upload to CompuServe, we select function nine "disk commands," from the main menu. All disk functions are carried out from this option. Generally, most functions that can be invoked from immediate mode can be invoked from the disk commands option. The disk commands available are: KS (KSM save), KL (KSM load), DI (display disk directory), DS (save buffer to disk), DL (load

♦ to page 154

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THE PLAN—Schools join together to form a cost-saving consortium of 50 or more members. One school or educational agency acts as Host. The Host will receive a master set of program disks and manuals. The consortium will be licensed to make as many copies of the masters as member schools need for their various computers.

THE BENEFITS—Consortium schools will automatically receive updates and new program releases at no increase in membership fee. There will be no shortage of quality software for the most popular computers.

THE COST—Only \$250 per school per year. There is an additional start-up cost of \$250 per school to cover initial expenses. Licenses for specific computers are available to large consortia or states at reduced cost.

ACT NOW—Form your own consortium and contact us. Contact us directly for the names of interested schools in your area.

At Last—A Software Solution

BERTAMAX INC.
Max Jerman, Ph.D.,
President



NEW!



Explore the ancient, mystical tomb of the great Pharaoh. Find the magical keys which lead you to unbelievable treasures as you out maneuver the creatures that slither and swarm about you. Super fast arcade action—this one will knock your socks off with 16 screens of incredible color and sound. \$24.95 cassette, \$27.95 disc. Requires 32K.

TIME FIGHTER

Pilot your MD-64 fighter through a hazardous time tunnel. Your mission is to destroy the dreaded Time Guardian who threatens the natural order of the universe. In order to reach this menace you must fight aerial dangers from strange and different time zones. \$24.95 cassette, \$27.95 disc. Requires 16K.



Mark Data Products

24001 Alicia Pkwy., #207, Mission Viejo, CA 92691 • (714) 768-1551

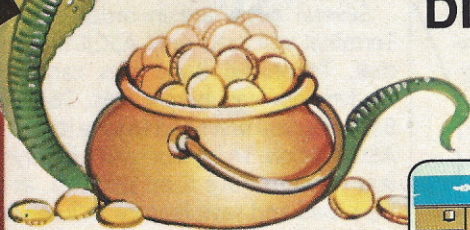
ORDERING INFORMATION: Phone your order for speedy delivery. Use your MasterCard or Visa. We also accept checks and money orders. ALL ORDERS: Please add \$2.00 shipping and handling in the continental U.S. All others, add air shipping and \$3.00 handling. California residents add 6% sales tax. Foreign orders please remit U.S. funds. Distributed in Canada by Kelly Software Distributors. SOFTWARE AUTHORS: Contact us for exciting marketing details.

NEW!

SENSATIONAL! GRAPHIC ADVENTURES

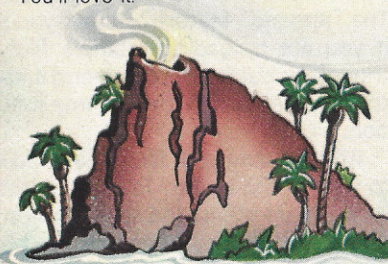
DISC NOT REQUIRED

Cassettes \$24.95 ea.
Discs \$27.95 ea.
32K Required



SHENANIGANS

From the heart of the city to lonely wilderness. An action filled journey to find the fabled pot of gold at the end of the rainbow. The first of our sensational new hi-res graphic adventures. You'll love it!

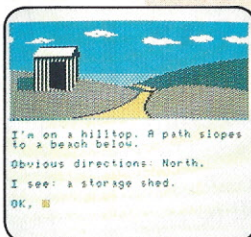


CALIXTO ISLAND New Hi-Res Version

A challenging puzzle with an occasional twist of humor. You'll visit a secret laboratory, a Mayan pyramid and you'll meet crazy Trader Jack—all in living color and exciting detail. A classic!



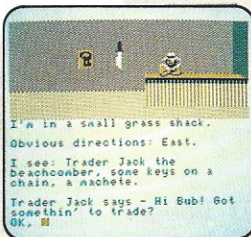
I'm in a marshy field at the base of a steep rocky hill.
Obvious directions: West.
I see: an unusual looking device.
OK, []



I'm on a hilltop. A path slopes to a beach below.
Obvious directions: North.
I see: a storage shed.
OK, []



I'm on a warm tropical beach.
Obvious directions: Up.
I see: a grass shack, sand, a lot of ocean.
OK, []



I'm in a small grass shack.
Obvious directions: East.
I see: Trader Jack the Beachcomber, some keys on a chain, a machete.
Trader Jack says - Hi Sub! Got somethin' to trade?
OK, []

Actual photographs taken from Calixto Island screen.

BLACK SANCTUM New Hi-Res Version

Encounter the forces of black magic as you roam around an old 18th century monastery. You'll see all the evil locations in this spooky adventure in full hi-res detail. If you enjoy suspense, this one's for you.



SEA QUEST

Get your shark repellent and scuba tanks ready to search for treasures under the sea. You'll run into a pirate, a mermaid and hungry sharks in this colorful and unique adventure. Outstanding!



OTHER GREAT GAMES FROM MARK DATA

BUMPERS

Tension mounts as you wildly race through a hidden obstacle course. Barrier walls are invisible until you bump into them and you must proceed cautiously as each dead end has a hidden booby trap. Especially exciting when two players compete simultaneously.

COSMIC CLONES

Clonial Warriors, Super-Klones, Double Bombs and "the Death Layer" relentlessly challenge the most skillful player in this unique, fast action game. This is one of our favorites.

GLAXXONS

Pit your playing skill against squadrons of swooping, diving spacecraft. Fast and furious with seven selectable skill levels and automatic game acceleration... guaranteed to blister your joystick finger.

EL BANDITO

El Bandito has to be a crafty little hombre to stay alive as he loots the local countryside. Escape into a tunnel to avoid that angry spider... race around the corner towards your lair. Two players may compete simultaneously in this unusual game.

All games: Cassettes ... \$24.95 ea. Discs ... \$27.95 ea. 16K Required



Mark Data Products

24001 Alicia Pkwy., #207, Mission Viejo, CA 92691 • (714) 768-1551

ORDERING INFORMATION: Phone your order for speedy delivery. Use your MasterCard or Visa. We also accept checks and money orders. ALL ORDERS: Please add \$2.00 shipping and handling in the continental U.S. All others, add air shipping and \$3.00 handling. California residents add 6% sales tax. Foreign orders please remit U.S. funds. Distributed in Canada by Kelly Software Distributors. SOFTWARE AUTHORS: Contact us for exciting marketing details.

CoCo Tax

Take the work out of calculating your 1983 income taxes. Use your Color Computer and CoCo Tax to allow you to pay the least amount of tax and receive the largest return possible. CoCo Tax supports these IRS forms:

- Form 1040A
- Form 1040A Schedule 1
- Form 1040 Schedules A, B, G, & W
- Form 2441
- 1040-1040A Comparisons
- Compares tax payment possibilities
- Runs on all Color Computers, 32K MIN

When next year's taxes are due all of this year's CoCo Tax purchasers will be eligible to receive all changes ready to type in for a nominal fee.

ONLY \$39.95 Cassette
\$44.95 Disk
 (Tax deductible. 32K Min.)
 Check or M.O. N.J. Res. add sales tax.

CoCo Tax
P.O. Box 950, Mt. Holly, N.J. 08060
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Schedule A-Itemized Deductions

1983

SAVE MONEY on Your Taxes this year!

B L A C K J A C K P R O



BLACKJACKPRO

A computer assisted learning tool
to condition you to make
the right play effortlessly
and beat the house.

Read about BLACKJACKPRO on page 74.

BLACKJACKPRO is a trademark of Skillware Corporation

S K I L L W A R E

from page 150

a file from disk into the buffer), DR (rename a disk file), and DK (kill disk file). Hit the Break key to return to the main menu.

Several notes are in order here. VIP Terminal will load only ASCII files from disk. Tokenized Basic files cannot be loaded, nor can binary files. To load a Basic file, you first need to save it with the ASCII option. To load or save a binary file, you need to have it on cassette, as the tape load and save feature includes a binary option. The documentation does not explain why this is the case but I tried it and can verify that only ASCII files can be successfully loaded from disk.

VIP Terminal will support more than one disk drive and also has the ability to allow you to append disk files to each other within the capacity of the buffer. The "append" feature can save you time if you are uploading multiple files, although I would not recommend it unless the files are headed for the same destination.

After loading your file, it's a good idea to look at the buffer. To do that, return to the main menu and select option six, "display a buffer." Note that the buffer display uses graphics text (if it is turned on) as per the parameters set in option two (more about this later). When we have viewed our file in the buffer, we return to the main menu. If we want to print the buffer contents at this point, we'd select option seven. Option seven sends another menu that asks us to select a data transmission rate and decide whether or not we want linefeeds sent. Once we have made these decisions, the entire buffer will print. If you want to interrupt printing, press the space bar — pressing any key will resume printing. Pressing the Break key stops printing and displays the main menu.

One difficulty in using the printer is that it uses the same RS-232C cable the modem uses. Generally, both devices cannot be connected at the same time. If you're going to use the print feature a lot, consider buying an RS-232 switch-box which will allow you to have both the printer and the modem connected. You simply select with a switch which one will be operational at any given time.

The print facility can also be used while viewing the buffer and will print a selected portion of same. To stop the printer, press the Break key and the program will return you to the main menu.

One drawback of VIP Terminal is the inability to edit the buffer contents.

Some type of editor would be a nice enhancement.

Communicate!

Now that the file is loaded, we're all set to establish communications. From the main menu, select option two, "changing communications parameters." This option lets us set up our communications configuration before actually going on-line. The parameters that can be selected include the display parameters and the RS-232C protocol parameters.

The display parameters include line length and display color. Length options are 32 x 16, 51 x 21, 51 x 24, 64 x 21, 64 x 24, 85 x 21 and 85 x 24. All displays (except 32 x 16) include graphically generated lowercase characters with descenders. When using the 64-character line, a narrow or wide character set may be selected. On a television display, the 64-character line is barely readable. The 85-character line is not readable. The 85-character line is good for viewing formats, however, when you have created a file and want to see how it will look on a standard 80-character screen. The 51-character option is very pleasing and is the default option. I tried using a composite monitor and found the 64-character display to be readable. The 85-character display was barely readable and unacceptable for normal work.

The color options are black on green, black on white, green on a dark background or white on a dark background. On my black and white television, I used black on white most of the time because it seemed to be the most pleasing display and had the best resolution for using the 64- and 85-character lines. Black on green worked well on a color television.

The documentation points out that using the 32 x 16 display requires no graphics and, hence, works faster. I tried this and found a noticeable difference in scrolling when using the 32 x 16 display at 1200 baud. I detected very little difference at 300 baud. Color display options are actually invoked from the communications mode (main menu option number one) rather than from option two. All line lengths are set from option two.

Option two also gives you the opportunity to set your own RS-232 protocol parameters. This is especially important if you are communicating with another computer. The defaults are set up to

allow communications with most bulletin boards and databases such as CompuServe.

Baud options are 110, 300, 600, 1200, 2400, 4800 and 9600. The menu gives you the option to select your baud from these choices only.

Word length can be set at seven or eight bits; parity at odd, even or none; and stop bits from one to nine. Your mode can be set to half duplex, full duplex or echoplex (used at 600 baud or less). You have the option of turning linefeed on or off and of deciding whether or not to pass control characters. By "pass," I mean to go ahead and pass control characters to the buffer. The option is to not pass them to the buffer by screening them out first. If they are not passed (default), the system will react to them. For examples, if a linefeed is received a linefeed will be executed.

A similar option is the "character trapping" option. This allows you to "trap" certain characters you don't want on your screen. If you want to trap characters, designate the Boolean operation (GT, EQ, LT) and the character value. Each character received will be tested.

For uploading you will often want to set up your terminal so a designated delay will take place between sending lines of text. Options are to delay between lines, or to wait for a prompt before sending a line. A prompt can be selected, but only one. Often, a prompt will consist of multiple codes. Using VIP Terminal, you would need to designate the first code of the sequence.

Once we have set all our communications parameters, we are ready to go on-line and establish our communications link. Selecting main menu option one, "communications," we see a screen that is set up the way we previously designated.

VIP Terminal also has a "graphics" mode which lets you download graphics. In this mode you will automatically be switched to the 32 x 16 display. To return to your selected display, press the Clear and Shift keys and the character "a" key, or return to option two on the main menu and reselect the display option. While in communications mode, you may return to the main menu by pressing SHIFT @. Returning to the menu will not have any effect on what is taking place in communications, and that means you can effectively leave communications on hold while tending to other housekeeping duties. One caution: When you re-

turn to the communications mode the screen will be clear. If the other computer is expecting input, you should take note of the prompt *before* leaving communications mode.

In communications mode, the top of the screen displays the buffer status (open or closed) and the case status ("L" for lower and upper, and "U" for upper only). The buffer may be toggled on or off by pressing the Shift key and hitting the Left Arrow key.

To open communications with CompuServe, dial the local CompuServe number and initiate log-on procedures. Enter communications mode, connect to the local number, and get the prompt to enter our user identification. Since we programmed KSM1 for this, simultaneously press the Clear and "1" keys. We'll be asked for our password. We programmed KSM2 for that, so simultaneously press the Clear and "2" keys. Once logged on, we follow CompuServe procedure to upload our file. When ready to upload, press the Shift and Left Arrow keys. When uploading is complete, we receive a prompt from the host.

To download a file, we open the buffer and begin receiving. To clear the buffer, we use option three from the main menu. That will give us a fresh start. To download, we may also want to use the "auto buffer" option (made available during the clear buffer operation). "Auto buffer" allows for the automatic capture of data sent by most bulletin boards or on-line databases. Using the auto buffer option, you need not manually open and close the buffer. That is done automatically from the host that is downloading.

Once the new file is in the buffer, we may use the disk commands to save the file to disk.

VIP Terminal handles even more features than all these. Numerous combinations of features can be used to other advantages.

The documentation that accompanies the VIP package is outstanding. It is of professional quality and comes in a three-ring looseleaf binder. I have found very little that I have not been able to do with this program. Its weak points are minor when compared to its overall power. I recommend VIP Terminal to anyone who is serious about using the power of the microcomputer for data communications. It represents a significant upgrade over earlier versions of Super Color Terminal.

—by Norman Garrett

NEW:PRODUCT\$

PowerMAX

Panamax
150 Mitchell Blvd.
San Rafael, CA 94903
(800)472-5555

PowerMAX does more than protect your computer system from power spikes, surges, and radio frequency interference. It switches from ac power to its batteries in the case of a power interruption or failure. It provides 200 watts for up to 15 minutes, giving you time to effect an orderly shut down. When power is restored it automatically switches back to ac voltage. PowerMAX comes with audio and visual alarms that go off during outages. It also lets you know how much standby emergency power time is left. Its battery is rechargeable. The unit costs \$429.

Chess-D

Computer Systems Distributors
Box 9769
Anaheim, CA 92802
(714)772-1390

Got the urge to play chess but no one to play with? Computer Systems is distributing Chess-D for Software Dynamics, a separate Anaheim firm. You'll need 64K of RAM to run this program, which inspects thousands of moves per second and, in tournament mode (three minutes per move) can look ahead at least five plays. You can change the look ahead level at any point during play from novice to expert. En Passant, castling, and promotion moves are all recognized. Moves are entered on the keyboard via algebraic notations. You can be black or white or change sides in the middle of the game.

Chess-D costs \$39.95 on cassette, \$49.95 on disk.

Skipcounting

B5 Software
102 Bainbridge Place
Columbus, OH 43228
(614)276-2752

To help elementary school children better learn mathematical concepts, B5 is marketing Skipcounting. Kids pick a number range anywhere from zero to 9,999,999, and then pick a number to "count" by; that number can be any number from one through 10, or any one of the following: 15, 20, 50, 100, or 1000. Then they watch the computer run through its paces, or use it to check their own work. Students can count backwards with this program, too. Lessons end with

a counting song and a graphics reward. The program requires Extended Basic and costs \$16.95 cassette, \$18.95 disk.

Time Fighter

Mark Data Products
24001 Alicia Parkway #207
Mission Viejo, CA 92691
(714)768-1551

Arcade action for 16K Color Computers in Time Fighter means you must destroy the Time Guardian at the end of the time tunnel while piloting your MD-64 fighter. You must first, of course, fight aerial dangers from other time zones. This assembly language game can be played by one or many players. Joysticks are needed. It costs \$24.95 for 16K cassette systems, \$27.95 for 32K disk systems.





Number Kruncher

Moonshot Acres Software
Box 423
Rockfield, KY 42274

Number Kruncher, when appended to another financial program, lets you do calculations on a section of the screen while the main program is running. That screen's section can be of different sizes (from nine to 13 percent of the whole screen) and in different locations. It eliminates the need for a hand-held calculator, and can also be used independently. This program costs \$7.95 and will run in 16, 32, and 64K and on any version of the Color Computer.

Intelligent Disks

Omni Resources, Inc.
50 Howe
Millbury, MA 01527
(617)1865-4451

Heat and humidity are the bane of all disks, and account for the loss of data in many situations. Omni believed that attaching heat and humidity sensors would be a step in the right direction. The firm also figured that extra strict speci-

cations ought to be adhered to during disk manufacturing to reduce the chances of malfunction during use; hence, Intelligent Disks. Patents are pending on the sensors used in this new product. Each sensor is the type that changes color when conditions reach a certain point. The gray-white heat sensor turns black a set number of degrees below the 125 degree Fahrenheit danger point; the blue humidity sensor turns gray, then pinkish, then full pink as the humidity level reaches its danger point. Signal level tests for the disks are conducted at more than 50 percent beyond industry standards, Omni says, and each disk comes with a lifetime warranty. The suggested retail price for a box of 10 single-sided, double-density disks starts at \$52.50.

Your Color Computer

Sybex
2344 Sixth Street
Berkeley, CA 94710
(415)848-8233

Author Doug Mosher has another book out, *Your Color Computer*, a 350-page general text on the Color Computer

♦ more

PRO-COLOR-SERIES

PRO-COLOR-FILE *Enhanced*

\$79.95 D

This high level data base development program offers the ability to track any type of information. From Mailing Lists to Expense Records, to Inventory or Court Trials, PRO-COLOR-FILE has the versatility to handle it.

60 Data fields
Upto 1020 Bytes per record
Use 1-4 Disk Drives
4 Color Data Entry Screens
28 User defined Equations
Scan File Alphabetically
Duplicate records
Duplicate fields

8 Report formats
Summary Reports
Screen Reports
Page titles, numbering
Sort on any Field
Sort 3 Fields at once
Sort any size file
Select sub-sets of file

See Reviews in:

Color Computer News -- June 83
Hot CoCo -- August 83
Rainbow Magazine -- June 83

PRO-COLOR-FORMS

* NEW *

\$39.95 D

Generate customized letters by merging PRO-COLOR-FILE data files with a letter. Print a personalized letter to everyone on your list. PRO-COLOR-FORMS will place data anywhere on a full page, even within the text of a letter.

Embedded control codes
6 User designed forms

32 to 133 characters
7 to 66 lines

Have your data printed on pre-printed forms or design your own. Requires PRO-COLOR-FILE to use.

PRO-COLOR-DIR

* NEW *

\$24.95 D

Compile a master listing of all your directories in one data file. This utility program will read a diskette's directory and place the information in one master file. PRO-COLOR-FILE is then used to generate reports or search and update. PRO-COLOR-DIR will store:

Diskette ID name
File name/Extension
File type (Basic, ML, Data)
Number of Sectors allocated
ML Load and Execute address

Date Created
Date Updated
Number of Grans allocated
Number of Sectors used
ML file length

Store 1000 entries! Requires PRO-COLOR-FILE to use.

See your local dealer or send check or money order to:
Derringer Software, P.O. Box 5300, Florence, SC 29502
Visa, MasterCard customers call (803) 665-5676 after 6 pm.
Add \$2.00 for Shipping and Handling No C.O.D.'s

PRO-COLOR-FILE, PRO-COLOR-DIR,
PRO-COLOR-FORMS (C) 1983
Derringer Software

All programs require 32k Color Computer Disk System
(Does not require joysticks!)

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8 8 Radio Shack
119 63 Saturn
131 75 Selected Software
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82 42 Skillware
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138 — Tom Mix
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92 — Woodstown Electronics
116 60 York 10



intended to help users learn about everything from setting up to programming. Chapter titles include: The Mind and Body of a Color Computer, Programs You Can Buy/Services You Can Call Up, Learning How to Program, and Ideas for the Future. The book also contains programs, cartoons, diagrams, and color photographs. It costs \$12.95.

The Wire Tree

Network
203 Harrison Place
Brooklyn, NY 11237
(212)821-7555

The Wire Tree is a four-outlet filtered power source designed to protect personal computers against voltage surges, spikes, and radio frequency interference. Surge limiting circuitry is built into its grounded outlets. The same circuit absorbs spikes

with rapid decreases in impedance. Radio interference is blocked with a filter that cuts out transverse and common mode noise. The Wire Tree comes with a nine-foot cable power cord, four peripheral power cords, and a one-year warranty. It costs \$69.95.

Software Printer Spooler

Software Connection, Inc.
5460 North State Road #108
Fort Lauderdale, FL 33319
(305)484-7547

The Software Printer Spooler gives you a 9.5K printer buffer on a 64K tape-based Color Computer. It's an assembly language program that frees your computer to work on other things while your printer prints at its leisure. It costs \$15.95.

FOR...NEXT (04,83)

APRIL FOOLS! That is — do be sure to read our April issue. Dennis Kitz has planned the game of Life in Color ... We'll have new adventures of the Sorcerer's apprentices ... some nifty game programs (including more Summer Project winners) ... and the finest in computer fiction — "Behind The Fallen Gate." We'll also take a close look at robotics, as well as continue our usual favorites. All in all, an issue you won't want to miss!

Color Computer/159

THE Color Computer

MAGAZINE

TO: **The Color Computer Magazine** Readers
FROM: Kerry Leichtman
RE: End of File
DATE: March 1984



Creating **The Color Computer Magazine** month after month has been and continues to be fun. It seems like we've been at it for years: many years. This March issue represents our first birthday. Much has happened to the magazine *and* the Color Computer since that first issue.

Volume 1, Number 1 totalled 68 pages and reached 30,000 of the (guesstimated) 300,000 Color Computerists in the United States and abroad. This 160 page issue will reach at least 65,000 of the world's 650,000 Color Computer owners. We take pride in all these growth figures.

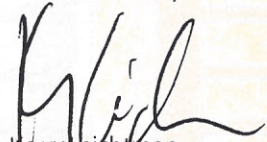
A year ago there was one TRS-80 Color Computer. Now there's the 64K Color Computer, Color Computer 2 Standard and Extended, MC-10, and before 1984 is through the Color Computer will birth multiple offspring. Our now retired mercedes silver friend has spouted a family of computers that is, more than it was a year ago, the best general purpose home computer available today. Mine is not a biased opinion; it is what I truly believe.

Although it is *our* birthday and not the Color Computer's, this March issue is a milestone of many sorts. We'll celebrate it simply, by pledging to continue our dedicated coverage of your machine. We'll celebrate by thanking (unnamed) the many folks responsible for the creation, distribution, and innovative enhancements to the Color Computer, and by thanking Barry Thompson, Mark Yamagata, and Ed Juge of Tandy for continuing to believe in and support the Color Computer.

Yet another milestone we are celebrating: You may have noticed a substantial change in our masthead (the small-type listing in the front of the magazine, listing our staff). In December **The Color Computer Magazine** joined the Ziff-Davis family of computer magazines. Our new relatives include *Creative Computing*, *PC*, *Microsystems*, *A+*, *Computers & Electronics*, and many, many more. This is our first issue published under new ownership. Our editorial offices remain in Camden, Maine. We are happy, in fact mildly ecstatic, over the resources now available to us through Ziff-Davis. We will share them with you in future pages.

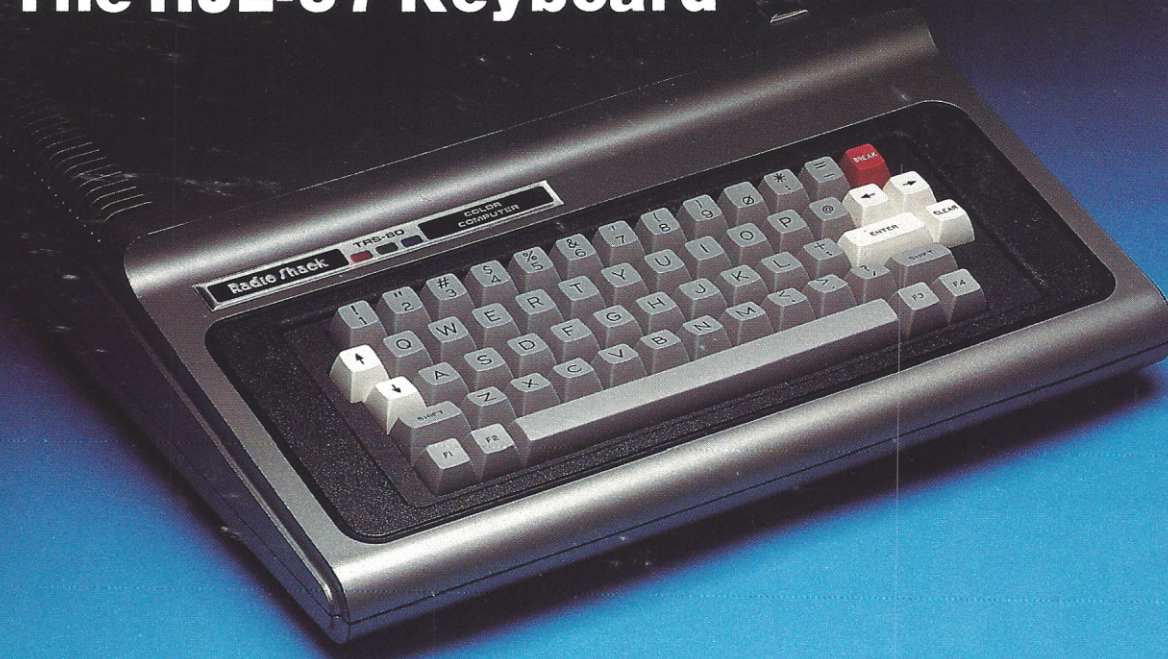
Your support has made us the largest circulated magazine serving the Color Computer. We thank you and wish you a happy birthday, too.

Yours in color,


Kerry Leichtman
Editor-in-Chief

Ziff-Davis Publishing Company / Highland Mill / Camden, Maine 04843 / (207) 236-9621

The HJL-57 Keyboard



Compare it with the rest. Then, buy the best.

If you've been thinking about spending good money on a new keyboard for your Color Computer, why not get a good keyboard for your money?

Designed from scratch, the HJL-57 Professional Keyboard is built to unlock ALL the potential performance of your Color Computer. Now, you can do real word processing and sail through lengthy listings...with maximum speed; minimum errors.

At \$79.95, the HJL-57 is reasonably priced, but you can find other CoCo keyboards for a few dollars less. So, before you buy, we suggest that you compare.

Compare Design.

The ergonomically-superior HJL-57 has sculptured, low profile keycaps; and the three-color layout is identical to the original CoCo keyboard.

Compare Construction.

The HJL-57 has a rigidized aluminum baseplate for solid, no-flex mounting. Switch contacts are rated for 100 million cycles minimum, and covered by a spill-proof membrane.

Compare Performance.

Offering more than full-travel, bounce-proof keyswitches, the HJL-57 has RFI/EMI shielding that eliminates irritating noise on displays; and four user-definable function keys (one latchable), specially-positioned to avoid inadvertent actuation.

Free Function Key Program

Your HJL-57 kit includes usage instructions and decimal codes produced by the function keys, plus a free sample program that defines the function keys as follows: F1 = Screen dump to printer. F2 = Repeat key (latching). F3 = Lower case upper case flip (if you have lower case capability). F4 = Control key; subtracts 64 from the ASCII value of any key pressed. Runs on disc or tape; extended or standard Basic.

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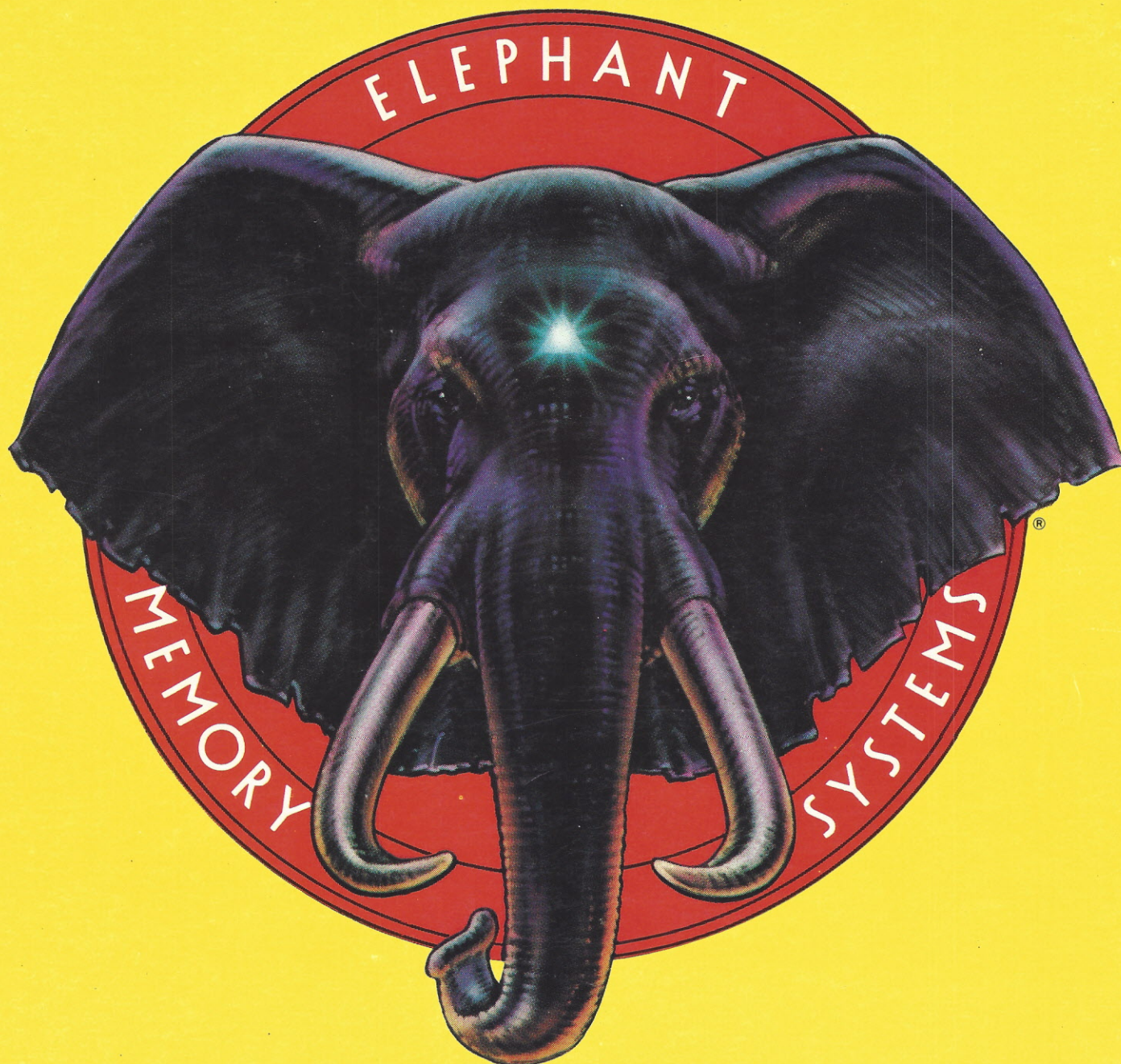


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